Vol. XV.
No. CCCLXX.

DECEMBER 27, 1884.

Price, including
Index, Fourpence.

JAN 7 1885

# THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW

LONDON: PUBLISHING OFFICE, 22, PATERNOSTER ROW, E.C.
New York: D. Van Nostrand, 23, Murray Street, and 27, Warren Street. Paris: Madame Veuve J. Boyveau, Librairie Etrangère, 22, Rue de la Banque. Berlin: A. Asher & Co., 5, Unter den Linden.

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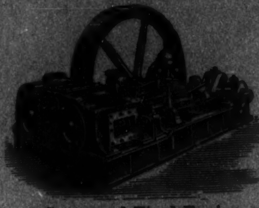

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THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XV.—No. 370.

## THE ELECTRIC LIGHTING ACT.

A FURTHER contribution to the arguments which have been adduced in advocacy of amendment in the Electric Lighting Act of 1882 appears in the form of a report made to the Society of Dynamicables, a committee having been specially appointed by that body to consider the terms of the Act and its possible effect upon the industry it was framed to facilitate. This report will probably have some weight, in consideration of the influential position of the individual members rather than of any importance which attaches to the Dynamicables as a society, it being, nominally at least, a social one only. The conclusions arrived at are very much what might have been expected, and at the same time that they do not advance anything startlingly new, the whole report is reasoned out in a more elaborate and more logical manner than has been the case in anything we have hitherto seen upon the subject. In effect the report recommends that clause 27 should be repealed, or, if this is not done, that the term should be considerably lengthened, and the price to be paid by the local authority for the undertaking should be its market value as a going concern; that the undertakers should be permitted to charge by light or by meter, as they may prefer, and that in the former case the provisions of the Gas Acts, to the effect that no lamps shall be used other than such as have been provided or approved of by the undertakers, should be incorporated in the Electric Lighting Act; that where the Local Authorities are themselves holders of Provisional Orders, they should not have, as in other cases, an absolute veto on applications for licenses in their districts; that the form of model Provisional Order (that granted for the experiment at Colchester) should be amended by the provisions with regard to the compulsory laying down of mains being omitted, and the undertakers being allowed to determine for themselves what mains they shall lay down, and by the power to require a supply being limited to consumers who are prepared to take the supply contracted for during at least 1,000 hours in the year; and that the form of license adopted by the Board of Trade should be so far remodelled that holders should be permitted, with the consent of the local authority, to use streets for the purpose of such private or limited supply as they may undertake to give, without being compellable to give any other or public supply. As we have said, most of this is a repetition of what has been asserted before; but none the less the report is to be welcomed as forcibly showing that there is great need for that amendment which it advocates.

We have so often, latterly, urged the injustice of some of the clauses of the Act—notably, the 27th, or "compulsory purchase" clause—that we shall not be misunderstood when we remark that there is great danger of the public being misled by what is being said and written with regard to the prohibitive effect of the Act. It is contended by those interested in the agitation that it is this erratic piece of legislation alone which stands in the way of the electric light being supplied to the public in a convenient form, and at a moderate price. But surely this is a fallacy. Nothing has as yet been done to show that a public supply can be made commercially successful. The installation at Colchester, interesting as it has been as an experiment, has not been of such an encouraging nature as to lead the holders of Provisional Orders in other districts into emulation; in fact, we scarcely dare to hope that the results have been sufficiently satisfactory to warrant the long continuance of the installation. While with regard, also, to the Edison installation in America, the largest of the kind, notwithstanding the immense advantages America possesses over England for the extension of electric lighting in respect of the higher price of gas, it has been proved beyond doubt that the financial results have been of a somewhat disappointing character. Therefore, before insisting so strongly that a modification of the Electric Lighting Act would remedy the whole of the evil and lead to a general use of the light, we would advise contractors to assure themselves that the thing is possible at the present moment under legislation of the most favourable kind. That amendment or repeal of the clause would leave them with much greater freedom to push the industry to greater possibilities of success, we admit and contend; but we deprecate the attempt to lay the whole of the blame for the present state of things upon the Electric Lighting Act.

## A NEW GALVANOMETER.

### By J. ROSENTHAL.

SINCE G. Wiedemann gave the reflecting tangent galvanometer a form which made it suitable for fine measurements, it has been generally used by physiologists in investigating the phenomena of animal electricity. The use of the instrument has been made still more convenient by astaticising it with a Hany's rod, as recommended by Du Bois Reymond, and by rendering the vibrations aperiodic, so that the sensitiveness of the instrument has been increased to a degree previously unimagined, the result being that it meets all requirements, both as regards accuracy and delicacy.

Along with these tangent galvanometers the forms indicated by Thomson have alone met with approval. The old form of Nobili's galvanometer has been almost entirely superseded by the recent improvements.

But however excellent the instruments mentioned may be they have this defect, that in them the arrangement of the winding of wire is very unfavourable, so that sensitiveness can be attained only by a disproportionate increase of the number of coils and a consequent augmentation of the resistance. An immediate result is that for a Wiedemann's galvanometer, if it is to serve for various experiments, at least three pairs of bobbins with different wires are needed; a pair for thermo-electric currents, a pair for the ordinary galvanic currents, and a third pair for experiments in animal electricity.

I have succeeded, by a new method of arranging the coils, in producing an instrument which, with a resistance of only 30 ohms, surpasses all previous galvanometers by far in delicacy, and can be used either for thermo-currents or for experiments in animal electricity.

This increased delicacy is particularly useful in the null observations, now so frequent, such as in determining resistances by means of Wheatstone's bridge, and in the measurement of electromotive forces according to the compensation method of Poggendorff and Du Bois Reymond.

The management of the instrument is very simple, and its price, in consequence of the simplicity of its arrangement, is not high.

The construction of the instrument is shown in the two figures, 1 and 2.

Fig. 1 represents an elevation of the galvanometer. On a marble foot, *f*, which can be placed horizontally by means of the three set-screws, *g*, *e*, *h*, are fixed the uprights, *m* and *n*, which support between them the plates, *i* and *k*. On *k* lies the damper, *d*, fixed by the screw, *q*, which catches in a nut at *u* (fig. 2). At *a* and *b* there are binding-screws in connection with the two ends of the wire coils.

Between *i* and *k* is the rotatory mirror case, composed of two semi-cylinders. On the plate, *i*, is screwed the suspension tube, A, at the top of which is the torsion-button *t*.

The arrangement of the essential portion of the instrument is seen in fig. 2.

The magnetic needle is a small horse-shoe magnet, *h*, to the poles of which are attached two curved, horizontal rods, *x* and *y*. These rods are wrought out of one piece of iron, with the magnet, and form its poles, upon which the deflecting action of the coils is exerted in immediate proximity and consequently most powerfully. The polar rods are quadrants of a circle, the centre of which lies in the axis of rotation of the needle. They pass, without touching, through the hollows of the two coils, *r* and *s*. These coils are formed each of 200 turns of a silver wire, 0·05 millimetre in thickness, covered with silk and wound upon ivory bobbins. The latter are inserted for half their length in the ivory support, *w*, which also holds the clamps, *a* and *b*. This supporter has the form of a parallelopiped, and is let into two longitudinal slits of the copper damper, *d*. It is screwed in this position by the glass plate, *p*, which is held fast by three small screws, like *c*, and closes the damper from below. The damper, prepared from a thick cylindrical mass of copper, is bored cylindrically in the centre. The horse-shoe magnetic needle is above the silver mirror, *s*, and along with it is supported by a cocoon thread.

In order to set up the instrument, the uprights are screwed to the marble pedestal, which is fixed horizontally. The suspension tube is screwed on, the cocoon thread introduced into it, the magnetic needle is attached and raised so that the mirror plays between *i* and *k*.

The damper is brought into its place, and adjusted, centrally at first, without the coils and the bottom closing-plate. The damper is then placed so that the slit for the support of the coils may form an angle of 45° with the extremities of the poles; the coil-supporter is inserted in its place and shut in with the glass plate, *p*. The damper, and with it the coils, are now turned so that the curved polar ends, *x* and *y*, may play freely in the hollows of the coils, which adjustment is facilitated by raising and lowering the cocoon thread correcting the centreing. This manipulation is much facilitated by placing the mirror, S, (fig. 1) under the damper. We can then see through the entire instrument by looking in the direction from T.

The dimensions of the entire instrument are :—

| | |
|---|---|
| Total height ... ... ... ... | 460 mm. |
| Height of suspension tube ... ... | 255 „ |
| Height of the damper ... ... | 39 „ |
| External measurement of damper ... | 39 „ |
| Internal measurement of damper ... | 20 „ |
| Height of horse-shoe magnet | 27 „ |
| Weight of horse-shoe magnet with mirror, | 4,300 grms. |
| External diameter of wire coils ... | 12 mm. |
| Thickness of wire coils ... ... | 3 „ |
| Hollow of wire coils ... ... ... | 5 „ |
| Resistance of both coils ... ... | 30 ohms. |

To give a preliminary idea of the delicacy of the instrument, the following results are given :—

Without compensation by Hany's rod, 0·000,000,005 ampère of current gives 0·1 mm. deviation with scale at the distance of 2,700 mm.

With compensation by Hany's rod, after aperiodicity has been obtained, 0·000,000,000,12 ampère gives 0·1 mm. deviation.

A thermo-element (nickel-silver and iron) with a difference of 10° C in temperature, and with the introduction of a resistance of 1,000 ohms, gives a deviation of 120 mm.

It appears *a priori* probable that, within the limits of the small deviations which occur on reading off the mirror with telescope and scale, the deviations thus read off will be proportional to the strength of the currents. But I did not consider it superfluous to satisfy myself of this point experimentally. To this end the current of a large Leclanche element, with the introduction of a great resistance (6,600 Siemens units) was passed through a platinum wire of one metre in length, extended rectilineally, and the portions of the current derived from two points of this wire were conducted through a wire coil of the resistance of 60 Siemens units and through the galvanometer. The deviations of the magnet which vibrated almost perfectly aperiodically were :—

| Distance of the points of deviation on the rheocord in mm. | Deviations, scale degrees, in mm. | | |
|---|---|---|---|
| | | | mean. |
| 10 ... ... ... ... | 6·0 | 6·0 | 6.00 |
| 20 ... ... ... ... | 13·0 | 12·0 | 12·50 |
| 30 ... ... ... ... | 18·0 | 17·0 | 17·50 |
| 40 ... ... ... ... | 24·0 | 24·0 | 24·00 |
| 50 ... ... ... ... | 29·5 | 30·0 | 29·75 |
| 100 ... ... ... ... | 59·5 | 61·0 | 60·25 |
| 200 ... ... ... ... | 118·0 | 122·0 | 120·00 |
| 300 ... ... ... ... | 176·0 | 184·0 | 180·00 |
| 400 ... ... ... ... | 240·0 | 245·0 | 242·50 |
| 500 ... ... ... ... | 296·0 | 305·0 | 300·50 |
| 600 ... ... ... ... | 355·0 | 367·0 | 361·00 |
| 700 ... ... ... ... | 415·0 | 432·0 | 423·50 |
| 800 ... ... ... ... | 476·0 | 495·0 | 485·50 |

If we consider the imperfection of the process, the agreement is sufficiently accurate. The greatest difference, the value 13·0 in one series when the distance of the rheocord is 20, is certainly 8·33 per cent. of the true value, but we have here probably an error in reading off the results. All the other errors fall within those boundaries which were to be expected under the conditions of the experiment.

The next series of experiments consisted in making a number of determinations of resistance in order to see what degree of accuracy could be attained. The arrangement was the usual one with the Wheatstone bridge. As comparative resistances, the nickel silver coils of a Siemens and Halske rheostat, with resistances from 0·1 to 5,000, or altogether 10,000 Siemens units, were employed. These resistances, along with that to be measured, form one part of the combination, and the platinum wire of the rheocord the other. The galvanometer was introduced into the bridge ; one of its arms was connected with the ends of the resistance to be measured and of that used for comparison ; the other arm terminated in a platinum knife edge placed upon the wire of the rheocord. If the standard resistance and the one to be measured are equal, the current in the bridge is null when the platinum edge is placed at the middle of the rheocord wire at the degree 500.

On using a Leclanche element and low resistances, the sensibility of the instrument was so great that it was exceedingly difficult to keep the magnet perfectly at rest, as small displacements of the slide of the rheocord gave deviations of 0·1 mm. in one or the other direction.

The measurements were rendered easier if the current was weakened by introducing a suitable resistance into the main circuit. For measuring greater resistances the current of the element was used undiminished.

I quote as examples the following measurements :—

1. Coil A.—Its resistance had been previously determined by means of Wiedemann's galvanometer as about 60 Siemens units. The measurement with the micro-galvanometer gave 60·1.

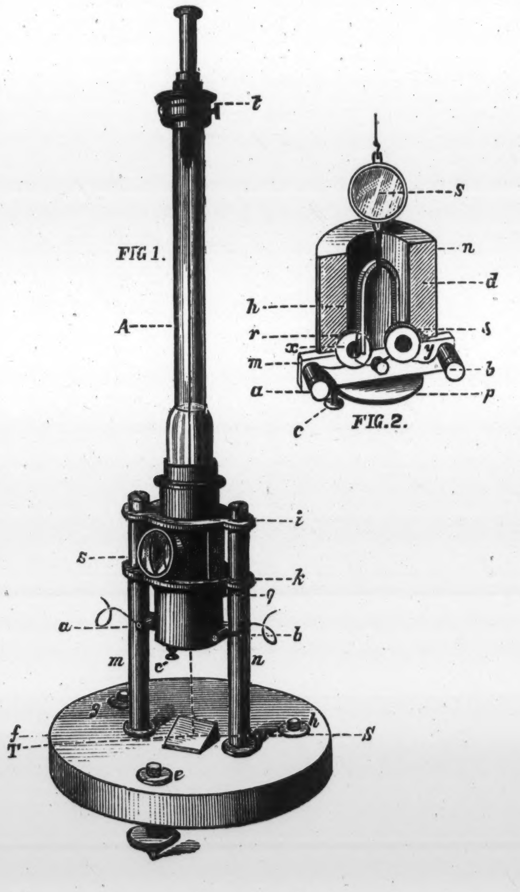
2. Coil B.—The secondary coil of a Du Bois Reymond inductorium, made by Krüger, of Berlin, and marked 4,990 U. Its resistance = 238·2 Siemens units.

3. Coil C.—The secondary coil of a larger inductorium of the same kind and from the same maker, marked "10,164 W, 784 E." I do not know whether the latter figures are to signify the resistance in Siemens units. If so the mark is erroneous, for the resistance was found to be 683 Siemens units.

4. The coils B and C together ; according to the above determinations = 683 + 238·2 = 921·2 Siemens units. The measurement gave exactly 921·2.

5. Syphon-shaped glass tube filled with a saturated solution of zinc sulphate, and inverted in a solution of zinc sulphate contained in two zinc troughs, amalgamated on the inside. Resistance, 7,470 S.U.

6. A longer and narrower tube, similarly arranged. Resistance, 38,780·5 S.U.



As the standard resistance was only 10,000 S.U., this last determination was obtained by displacing the platinum knife edge on the wire of the rheocord until the equilibrium in the bridge was restored.

The following facts will give a notion of the degree of accuracy attainable.

In measuring the coil C (683 S.U.), after restoring the equilibrium, the introduction of 0·1 S.U. gave a deviation of 10 mm. Thus a change in the resistance of 0·01 S.U. could have been easily detected, *i.e.*, 0·0146 of the value.

When the coils B and C were combined (921·2 S.U.), 0·1 S.U. occasioned a deviation of 6·3 mm., showing the limit of accuracy as 0·016 S.U., or 0·0017 per cent.

With the zinc sulphate solution of 7,470 S.U., 0·1 S.U. produced a deviation of 3 mm., or 0·004 per cent.

With the zinc sulphate solution of 38,780·5 S.U., 2·0 S.U. occasioned a deviation of 1 mm., or a limit of accuracy of 0·005 per cent.

Practically, such accuracy is not to be attained ; because the conductors are heated by the current, an effect which does not take place equally in the conductor to be measured and in the resistance coils of the rheostat. It will therefore be seen that a state of equilibrium has been obtained on keeping the circuit closed ; the magnet gets into motion again in one or other direction according as the heating is stronger in one part or the other. This defect does not depend on the galvanometer. On the contrary, it would be very suitable for determining temperatures on the method of Siemens, in consequence of its sensitiveness.

Another fault, however, depends on the construction of the instrument ; the constant shifting of the zero-point after the instrument has been astaticized by Hany's rod. This defect is common to all instruments astaticized in the same manner. In null determinations, such as measurements of resistances or of electromotive forces, this error is certainly very troublesome.

But if a degree of accuracy of 0·1 per cent. only is demanded, it is sufficient for the bulk of the necessary determinations.

In the measurement of induction coils we observe, on opening and closing the circuit, a convulsive movement of the magnet in consequence of the extra current. If the standard resistances have been coiled free from induction we obtain, after the re-establishment of the equilibrium, these extra currents perfectly free, so that these extra currents can thus be demonstrated in a similar manner to that which I showed previously. (*Electrotechn. Zeitschrift.*, Vol. IV., 1883, p. 147.)

The micro-galvanometer is especially adapted for measuring electromotive forces on the compensation method of Poggendorff and Du Bois Raymond. For the minute differences of potential which have to be measured in electro-physiological researches, very sensitive instruments are needed. As the micro-galvanometer was more especially constructed for such purposes, I was naturally anxious to know how it would compare with Wiedemann's galvanometer, which has hitherto been generally used for such purposes.

The muscular current of the sartorius of a small frog, taken from the equator and transverse section, threw the mirror quite beyond the extent of the scale ; a minute shred of this muscle, consisting of three fibres of 1 centimetre in length, gave with the same arrangement a deviation of 400 mm. After these results, I was much surprised at obtaining with the nerve current only small deviations of 20-30 mm. with the so-called strong arrangement, equator and transverse section, or about as much as Du Bois Reymond obtained with a Wiedemann galvanometer not astaticized. As the electromotive force of the nerves is not very much smaller than that of the muscles, the inferior sensibility of the micro-galvanometer must depend on the greater resistance of the nerves. Du Bois Reymond's galvanometer had 12,000 turns of fine wire, and my micro-galvanometer only 400. The latter instrument is superior when the resistance of the other parts of the circuit is trifling ; but this superiority must diminish more and more as these resistances increase. As in my first trials all clues to the dimensions requisite were wanting, the instrument has turned out sufficient for the majority of experiments, but not for the nerve current.

This defect can be easily remedied. I have ordered coils with a greater number of turns, and shall apply two magnets combined in an astatic system and four coils. The change of the magnets and coils can be easily effected after the mirror case and the bottom plate (*p*, fig. 2) have been removed. For a universal instrument, two magnets and two pairs of coils will be needed ; the one set for the majority of experiments, and the other for nerve currents. I shall in time report on the result of this modification.

The micro-galvanometer is devoid of one advantage, which Wiedemann's galvanometer possesses. In the latter, when powerful currents are being observed the sensitiveness can be decreased by removing the coils. To effect the same end with the micro-galvanometer, the introduction of suitable secondary contacts is necessary.

All things considered, I believe that I may recommend this new form of the galvanometer to physicists and physiologists. Its manipulation is so simple that it will certainly find friends. For demonstrations in lectures its use is very convenient. It is merely necessary to apply a different mirror case, which will permit the image of a source of light fixed on one side to be thrown upon a screen.—*Wiedemann's Annalen.*

## THE MEASUREMENT OF THE HORIZONTAL COMPONENT OF THE TERRESTRIAL MAGNETISM BY THE DEFLECTION METHOD.

Note by M. J. B. BAILLE.

THE horizontal component, $T$, of the terrestrial magnetism is ordinarily determined, absolutely, by Gauss's method, which gives at the same time the magnetic moment, $M$, of the bar. But there are several difficulties in the application of this method: two bars must be employed, and two observations independent of each other must be made at a rather long interval, during which the terrestrial force may vary.

I proposed to apply in these researches the ancient observation of Gambey and Arago upon the deflection of magnets, oscillating above a thick plate of copper. We know that a magnetised bar oscillating in the interior of a bobbin covered with wire undergoes a very different deflection, according as the coil forms an open or a closed circuit.

By measuring the deflection in the two cases, we obtain from the difference the moment, $h$, of the reaction which induced currents exercise upon the movable magnet. This element is connected with the magnetic moment of the oscillating bar, $M$, and with the electric constants of the coil (the resistance expressed in ohms, $W$, and the galvanometric constant, $G$, expressed in centimetres) by the known formula

$$M^2 = W G^2 h.$$

If, then, we measure $h$, and if we know the constants, $W G^2$, at the time of observation, we may calculate $M$.

Now, as we have already determined the directing couple, $T M$, by means of the duration of an oscillation, and by the knowledge of the moment of inertia, we may, by a division, obtain the number, $T$, in absolute units, C.G.S., for instance, if all the other elements have been measured with corresponding units.

This method is very simple and very rapid: it only necessitates the employment of a single magnet, which may be always the same, and it occupies only a few minutes. Besides, it appears, perhaps, more accurate still than the Gauss method, since it gives the horizontal component at the moment of observation. Moreover, the deflection of an oscillating movement is one of the most easy physical elements to determine with safety, when we take proper precautions to have good oscillations; and the observation may be made at the same time as that of the duration of the oscillations.

There are, however, two inconveniences which might rather seriously affect the measurements if we did not take them into account.

First, the self induction has the effect of altering the induced currents. It would be necessary, therefore, to make a suitable correction at each observation, but it is more simple to eliminate this cause of error; this is done by taking a coil, having a small number of convolutions of wire, and especially by attaching to the magnet a piece having a strong moment of inertia, so that the duration of an oscillation may be tolerably long.

Then the variation from declination has the effect of rendering the deflection dissymmetrical and causes an irregularity of oscillation. We may neglect this cause of error by taking care to make rapid observations and to imagine a pair of amplitudes. The declination may then be regarded as having varied regularly.

The constants of the coil, to be determined beforehand, are the electrical resistance, $W$, which we may measure by the ordinary process and which may be reduced by a suitable correction, to the temperature at the time of observation, then the galvanometric constant, $G$. This last element is rather delicate to obtain by the ordinary processes; but we might infer it from the first observations of deflection if we took care to place in the coil a bar of which the magnetic moment had been previously determined by Gauss's method.

I have applied the deflection method, such as I have just described, with a coil of which the electric elements had been measured separately. I determined the horizontal terrestrial component in my magnetic observatory at Villeneuve-Saint-Georges. From the very concordant resulting numbers which I obtained, I have extracted the following observations, in which the two methods have been employed concurrently (units C.G.S.).

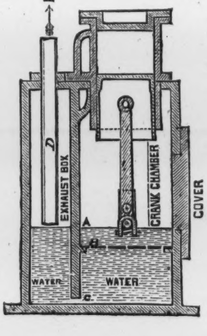
| 1884. | Magnets. | Gauss Method. | Deflection Method. |
|---|---|---|---|
| September 25 | A | 0·19430 | 0·19381 |
| ,, ,, | B | ·19413 | ·19532 |
| ,, 26 | M | ·19487 | ·19512 |
| ,, ,, | N | ·19450 | ·19464 |

As we see, the results are as concordant as possible, and the method seems to deserve perfect confidence.

## CHANDLER'S PATENT HIGH-SPEED EXPANSION ENGINE.

THE rapid strides made by the electric light within the last few years has opened up a wide field for "high-speed engines," and a considerable number has been brought before the public; of these, a few only have partially fulfilled the purposes for which they were designed.

We have recently had brought before our notice one which seems so constructed as to avoid the defects of former engines, and which is said to produce considerably better results. Chandler's Patent High-Speed Expansion Engines are of the single acting reciprocating type, and are made with one or two cylinders.



The inventor claims three important and excellent features. First:—The (patented) method of retaining the lubricant inside these engines. Second:—The system of lubrication by which all the parts are effectually and economically lubricated, without the aid of any lubricators. And thirdly:—The expansion valves for cutting off steam at any point of the stroke. A reference to the accompanying sectional drawing will enable our readers to understand how this is accomplished. A, oil floating on the water. B, perforated plate to prevent undue mixing. C, hole to allow superfluous water to pass away. D, exhaust pipe which carries superfluous water away. The beds, or boxes, are provided with a partition inside, on the one side of which are the crank shaft, connecting rods, eccentrics, and bearings of the crank shaft, all of which are thoroughly lubricated by the oil in the crank box; the rapid revolution of the cranks splashes the oil into all the working parts; the oil is kept floating on the water, and is used over and over again till all its lubricating properties are consumed; the superfluous water or condensed steam *only* passing through the hole, C, into the exhaust box. By this ingenious arrangement a quarter of a pint of oil is quite sufficient for a 5 inch single cylinder engine driving a Siemens 2,000 candle-power dynamo for 12 to 20 hours continuously, and without any attention whatever, at 950 revolutions per minute; thus a supply of oil sufficient to last two or three days can be put in at once, and the fact that no lubricators (which cannot always be depended upon, and are liable to get out of order) are required, is a consideration which will be highly appreciated. By the use of the expansion valves great economy of steam is effected, at least 25 per cent. being saved, as, not only can the steam be cut off at any point of the stroke, but also undue compression or back pressure is avoided.

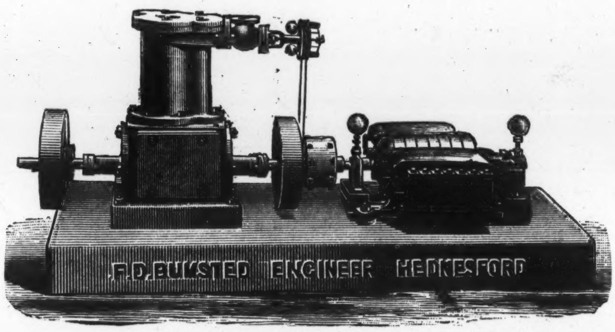


FIG. 1.

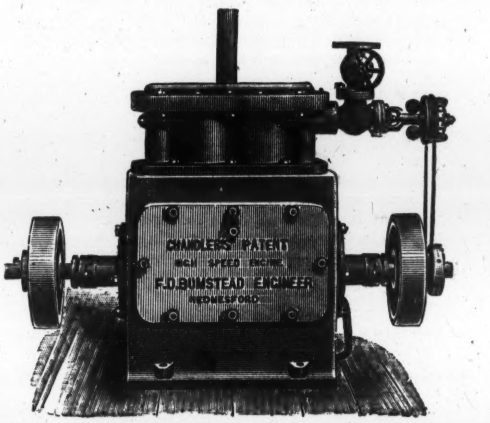


FIG. 2.

In the construction of these engines forged steel and phosphor bronze are used for the pistons and connecting rods, thus they are both light and strong, which permits of a greater speed than other engines. We saw one of these engines, a 4 inch double cylinder, driving a Siemens dynamo at 1,000 revolutions per minute, at the works of the manufacturer (Mr. F. D. Bumsted, Cannock Chase Foundry), and do not think we should be in error in saying that it fulfilled all the claims of the inventor.

These engines will also be found most useful for ship lighting, as they take up so small an amonnt of space, and for driving centrifugal pumps and fans.

On the 17th and 18th December, a bazaar, held in the Town Hall, Rugely, was lighted by a Crompton arc lamp of 2,000 candle power; the current was from a Siemens dynamo, running at 1,000 revolutions per minute, coupled direct to one of these engines just described, and which ran on each occasion for six hours without the slightest atttention. The engine, dynamo, and vertical Cochran boiler, were mounted on to an angle-iron carriage on four wheels, the total weight being 30 cwt., and forming a most convenient little portable installation.

**Anglo-American Telegraph Company, Limited.**—The *Financial News* last week gave some information respecting the prospects of this company, pointing out the necessity of a constant annual addition to the renewal fund, in consequence of the age of several of the cables, and repeating facts which have often been stated in the columns of the REVIEW.

## SECONDARY BATTERIES.

Mr. J. S. Sellon gives in a contemporary the following extracts from his own patent specification in 1881, and from that of Messrs. Parker and Elwell, of 1882.

| *Sellon's, September 10th,* 1881. | *Parker and Elwell's, August 4th,* 1882. |
|---|---|
| "The plates of lead may also be *roughened* on one or both sides by means of . . . *any chemical process* . . . in such a manner that to a suitable depth on each side of the plate a *spongy layer or projecting points or surfaces* are produced, which are either *suitable for retaining* the material hereafter to be made active or for *obtaining a more rapid formation of the plates* if used without such packing." | "The lead electrodes . . . are prepared in order to *facilitate their development* under the action of the electric current, by placing them in a dilute solution of sulphuric and nitric acids. The nitric acid oxidises and dissolves some of the lead and causes a *roughening, corroding, or honeycombing of the surface, whereby the plate is made capable of having formed upon it, and retaining when so formed,* a larger proportion of peroxide of lead during the action of the battery than if the plate were employed with its surface in the originally smooth condition." |

Mr. Sellon claims "roughening by *any* chemical process" his plates for a specific purpose, and Messrs. Elwell and Parker claim "roughening plates by means of *nitro-sulphuric acid.* A correspondent writing on the subject says:—

> Now it is well known that Messrs. Parker and Elwell have achieved great results with their battery, and in the electrical world it is very highly thought of, indeed considering its lightness and durability (its strength increasing with use) many regard it as being superior to the Faure-Sellon. I would therefore ask, does Mr. Sellon pretend to claim widely the use of "roughening plates" in all manners for this purpose? If he does and can, then the sooner our patent laws are altered the better.
>
> Since Planté's battery first appeared, no new and successful "active material" has been brought into use in so-called secondary batteries, and we all know that lead peroxide and spongy lead are the substances at present mainly depended on. One of, if not the greatest difficulty, is to make these chemically or electrolytically permanently adherent to the electrode, and the question is "Has Mr. Sellon, prior to Messrs. Parker and Elwell, manufactured a battery equal to theirs?" If not, his claim to priority can hardly be maintained on the simple basis of vague wording.
>
> Messrs. Parker and Elwell have found out that by acting on sheet or perforated lead or any lead surface with a mixture of nitric and sulphuric acids (one of which is a solvent, the other a precipitant of that metal), it may be roughened and its surface increased and fitted for the formation or reception, as the case may be, of the active material of secondary batteries. And I leave it to others to decide if this is not as great an invention as those on which many of Mr. Sellon's numerous patents are founded.

Shortly afterwards Messrs. Elwell and Parker wrote a letter to the following effect:—

> We are pleased to see that an unknown friend has taken our part. The effect of nitric acid in hastening the formation of Planté batteries was *not* known until the year 1882, although Mr. Planté himself had devoted a great part of his life to the subject, and had at various times tried several *chemical processes* long before the date of Mr. Sellon's patent. The effect of nitric acid is, perhaps, best described in Planté's specification of his patent of 1882.
>
> We quite agree with Mr. Sellon that an accurate knowledge of

the early history of secondary batteries is desirable, but we fail to see in what way he advanced the science by the matter contained in his specification; and, although it was at one time thought that Faure had improved upon the Planté battery, the results obtained do not confirm that opinion, Planté's own discoveries being, as yet, unsurpassed.

On the question of efficiency, the following data is of such importance that we have deemed it advisable to give our readers the results in full. Mr. Reckenzaun, who is undoubtedly entitled to speak with the voice of authority in such matters, communicates to *Engineering* as below :—

As there appears to be a want of reliable data, and I am in possession of such data, I will submit the same for comparison:

I. *The Elwell-Parker Accumulator.*

| | |
|---|---|
| Weight of lead plates in each cell ... | 40·2 lb. |
| Average charge ... ... ... ... | 60 ampère hours. |
| „ useful discharge ... ... | 30 „ |
| „ *rate* of charge ... ... ... | 10 ampères. |
| „ „ discharge ... ... | 12 „ |

II. *The Faure-Sellon Accumulator.*

| | |
|---|---|
| Weight of plates in each cell ... ... | 26·5 lb. |
| Average charge ... ... ... ... | 158 ampère hours. |
| „ useful discharge ... ... | 137 „ |
| „ *rate* of charge ... ... ... | 31·8 ampères. |
| „ „ discharge ... ... | 46 „ |

The results in Table II. are from actual practice with a set of cells used for propelling a forty-six passenger tramcar on an experimental line; the total weight of lead and oxides of lead in this tramcar is 1,590 lb., whereas with the Elwell-Parker accumulator I should require about seven times this weight of lead, or 11,000 lb., to give the same capacity and electromotive force, which would prohibit the use of secondary batteries for locomotion, apart from the fact that the Elwell-Parker cell gives an efficiency of $\frac{30 \times 1{\cdot}9}{60 \times 2{\cdot}3} = 42$ per cent., and that of the Electrical Power Storage Company $\frac{137 \times 1{\cdot}9}{158 \times 2{\cdot}3} = 71$ per cent., 2·3 volts being the average charging potential, and 1·9 volts the electromotive force per cell at the current rate stated.

The comparisons which I have established were not intended for criticism, but merely for my own information whilst engaged upon designs for electrical tramcars, where high efficiency, small weight, and great capacity in small bulk are essential.

In the same issue of our contemporary, Mr. J. S. Sellon publishes a long letter at the end of which more valuable information on the performance of secondary batteries is made known to the world. Mr. Sellon writes :—

A correspondent asks if I have produced a battery equal to the Parker and Elwell.

Messrs. Parker and Elwell state "that the Planté discoveries are as yet unsurpassed."

To this question and statement I have but one reply to make, viz., the relative figures given below of efficiency, capacity, weight, and cost of the respective forms. These were furnished to me by Mr. F. V. Anderson, and are a *résumé* of the results obtained by a continuous series of trials conducted early in this year by that gentleman, whose care, integrity, and reliability cannot be called in question, and whose experience in testing secondary batteries is by reason of the means which have been at his command, and the nature and conditions of the work and investigations he has carried on, probably greater than that of any living man. The figures may be confirmed by any committee of competent experts mutually agreed upon.

I may further say that the Storage Company's cells used for the comparison, were not of the newest and more improved type, which give a very much greater duty.

Several cells of each kind were operated upon and under precisely similar conditions.

*Parker-Elwell Cells.*

| | |
|---|---|
| Total weight of cell ... ... ... ... ... | 71 lb. |
| Average charge, 60 ampère hours, potential of ... | 2·3 volts. |
| Average useful discharge, 30 ampère hours, potential of... ... ... ... ... ... | 1·61 „ |
| Ampère hours per pound weight of accumulator | =0·423 |
| Watt hours per pound weight of accumulator ... | =0·808 |
| Kilogramme metre per pound weight of accumulator ... ... ... ... ... ... | =0·296 |
| Kilogramme metre per kilo. of accumulator ... | =0·651 |

Space occupied by cell, 12 × 10 × 10.

*Electrical Power Storage Company's Cells, the usual Indicated Horse-Power size, the nearest in Outward Dimensions and Gross Weight to the above.*

| | |
|---|---|
| Total weight of cell ... ... ... ... ... | 90 lb. |
| Average charge, 400 ampère hours, potential ... | 2·3 volts. |
| Average useful discharge, 300 ampère hours, potential ... ... ... ... ... ... | 1·94 „ |
| Ampère hours per pound of accumulator ... | = 3·300 |
| Watt „ „ „ ... ... | = 6·400 |
| Kilogramme metre „ „ ... ... | = 2348 * |
| „ „ per kilo „ ... ... | = 5166 * |

Space occupied by cell, 12 × 10½ × 7½.

NOTE.—The above memoranda (given as received) only deal with the gross weight of the cells tested. Estimating the net weight of lead in the Parker-Elwell at 40 lb., and in the Storage Company's at 70 lb., the figures should be :—

| | |
|---|---|
| Ampère hours per pound of lead, Parker-Elwell | 0·750 |
| Ampère hours per pound of lead, Storage Company... ... ... ... ... ... ... | 4·500 |

As stated above, this is very *considerably below* the results obtained from the Storage Company's cells as made at present, but I prefer to give the exact figures arrived at by Mr. Anderson, as derived from those he worked upon, rather than my own much higher figures, from the improved forms.

These results show, that apart from weight, *ten* Parker-Elwell cells, costing, I believe, 25s. each, would be required to give the same capacity as *one* Storage Company's cell costing 60s.

That in the matter of *efficiency* the Storage Company's cell is 20 per cent. (now greatly increased) above that of the Parker-Elwell.

That, as to weight, about *six tons* of Parker-Elwell lead plates would be required to do the work of *one ton* of Storage Company's plates.

*With the improved form and construction for motive power this one ton is now reduced by about one quarter.*

Other essential points for comparison, such as *rate of charge and discharge*, &c., I leave untouched upon, feeling that, as it is, I must apologise for the length of this letter.

Doubtless, Messrs. Elwell and Parker will challenge the accuracy of Mr. Sellon's figures, and probably more information of a technical character will shortly be forthcoming concerning the value of both forms of secondary battery. On the other hand, we are sure they will agree with Mr. Sellon that undoubted confirmation of the obtained data would be exceedingly desirable for the purpose of deciding once and for all upon the merits of the two systems as they now stand.

## ELECTRIC LIGHT CABLES.

Mr. J. G. Lorrain, of the Kinetic Engineering Company, writing to a contemporary recently, criticised statements made by another correspondent, who said that the laying of the Berthoud-Borel cables at Greenock in sand was "a great mistake," because he had noticed that lead water pipes are less corroded in clay soils than in sand, and that in sand they will not last seven hundred years, whereas in peat moss they remain as good after lying buried for that period as when first laid. Mr. Lorrain asserted that it is well-known that pure sand can itself have no chemical or corrosive action on lead, and said it was not intended to lay the Greenock cables in chemically charged sand. The cables, besides having their two sheathings separated by a layer of gas-tar, were to be painted over with tar before being laid in the sand. The object of tarring the outside of the external lead sheathing was simply to protect the lead from chemical action; indeed, it was the presence of tar constituents in the peat that explained why lead was so well preserved therein.

Mr. James Johnstone, of Edinburgh, subsequently wrote as follows :—"Mr. Lorrain, the proprietor of the Kinetic Engineering Company, writes that, 'It is well known that pure sand can itself have no chemical or corrosive action on lead.' This statement bespeaks a simplicity of mind which is surprising in these days of progress. The only naturally pure sand is that of white quartz, but it is found in very small quantities. As I have studied the geology of the neighbourhood of Greenock, I know that there is no white quartz sand to be found there. The nearest approach to it is a sand which is the *débris* of a stone which consists of white quartz sand held together by a lime matrix. Now the most destructive soil that lead pipes can be laid in is sand having in it a small proportion of lime. The colouring matter of red, yellow, and grey sands is the product of minerals embodied in the sand, and when lead pipes are laid in these sands galvanic action takes place, which corrodes the lead. I admit that if lead and pure quartz sand are kept together in a dry place that no chemical action will be developed between them. But are these the circumstances in which Mr. Lorrain is going to lay the lead-covered cables in the streets of Greenock? Far from it! The main cable,

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* Should not these read 23·48, 51·66?—EDS. ELEC. REV.

I understand, is to bring the electricity from the dynamo placed on the high ground behind the town, and passes in a trench, cut in very steep streets, which lead down to the docks and lower part of the town. Now, Greenock is notoriously a very wet place. When these trenches have been filled up, the surface rain-water is sure to find its way into them; and consequently the bed of 6 in. or 8 in. of sand in the bottom of the trench will become a drain, which will carry water from the higher to the lower parts of the town, and this water flowing along the lead coating of the cable will carry mineral matter along with it which will soon corrode the lead. Mr. Lorrain writes that the lead is to be coated with coal tar. This is so far good. But how long will the coating of tar last? In the early days of gas-making, when the tar was richer in carbon than the gas tar now made, the iron water pipes laid down in Greenock were coated with coal tar, but when these pipes were laid in a sandy soil the gas tar coating lasted a comparatively short period of time. There is an abundant supply of peat moss to be had on the hills behind Greenock. If Mr. Lorrain would fill the bottom of the trenches with it and embed the cables therein, he would then be doing that which would prove a permanent good."

Replying to Mr. Johnstone, Mr. Lorrain repeated his statement that "pure sand can itself have no chemical or corrosive action on lead," and added: "As for the sand to be used in the trenches, if the engineer in charge cannot procure it in the neighbourhood of Greenock, he will doubtless obtain it from further off. With that neither I nor my company have anything to do. We simply supply the cable to the contractor who has the job in hand, with such information and recommendations as our experience warrants. Mr. Johnstone says the rain-water is sure to find its way into the trenches. Exactly so. That is one of the reasons for using sand, because the water will precolate through it and pass away. Were peat to be used, as Mr. Johnstone thinks should be done, it would act like a sponge and retain the water. The sand can be obtained more free from impurities than peat, and not retaining the water as peat does, it forms a far better and safer bedding for an electric light cable. I do not say peat is a bad material, but it is not so good as sand. Mr. Jonnstone's parallel between tarred iron and tarred lead is delightfully innocent. Let him ascertain the relative affinities of iron and lead for oxygen in the presence of water or moist air—the duration of the tar coating depends chiefly on that—before he again exposes the chinks in his armour. If he ever gains any practical experience of the laying of such cables as those of the Kinetic Engineering Company, he will cease to pronounce their practice 'a great mistake,' as he has done in so gratuitously dogmatic a manner. Where the great mistake is he has probably now discovered, and, it is hoped, will avoid such in future. I may add that our reason for recommending sand is simply because an extended experience has shown it to be the best material for the purpose."

In reference to this controversy, Mr. E. W. Beckingsale wrote:—"As a matter of fact the lead-cored cables are being laid in peat. Though I am indebted to Mr. Lorrain, who supplied me with the cables, for the suggestion of the use of sand, yet, as peat can be obtained in the neighbourhood, and as it forms an excellent bedding, impervious to flowing water, and therefore a good preservative to substances embedded in it, I have decided with the authorities to use it. Mr. James Johnstone falls into a slight inaccuracy, which he will allow me to correct. As contractor to the Board of Police of Greenock, I have supplied the whole of the electrical plant, including cables, which are now being erected and laid under my personal supervision."

Mr. Andrew Jamieson, Principal of the College of Science and Arts, Glasgow, contributed the following upon the subject:—"As consulting electrician to the Greenock Corporation, who are introducing the electric light cables protected with lead tubing, I have been much interested in Mr. James Johnstone's timely warning regarding the corrosive action of certain qualities of sand on lead pipes. His opinions are borne out by practical experience, and due precautions will be taken to avoid contact between the lead and the destructive soil he mentions."

## THE NATIONAL CONFERENCE OF ELECTRICIANS, PHILADELPHIA.

*(Reported specially for the "Electrical Review.")*

*(Continued from page 475.)*

Prof. Rowland: I have listened with great interest to this discussion by Prof. Thompson. I have only one point. I am the defender of two theorems with respect to the machine, and that is with respect to round magnets and the simpler circuit. With respect to the round magnets I may state that I was very much astonished, indeed, I can say astounded, at the remark of Prof. Thompson that the magnetic force in the centre of the round coil was not the same in direction as at the surface. Indeed, it is so revolutionary, that I should imagine that it would produce such an effect on the scientific world as would a demonstration that the law of energy was not correct, or that gravitation did not vary inversely as the square of the distance. Therefore I must strongly dissent from that. I do not think the matter can be discussed. If anything further is said on it, it must be in the way of a scientific paper which will take up the subject, and make a grand sensation in the scientific world.

Prof. Silvanus Thompson: In certain cases the magnetism of a core may be reversed in the interior. The experiment is, I believe, old and well-known.

Mr. Keith: I desire to say that I tried that same experiment, and published the fact, not as my own determination, but in answer to an inquiry in *The Electrical World* some three or four months ago; not claiming it as my discovery, but simply as an observation that had been made.

Prof. Rowland: It only requires a moment to see what the real cause of this is. It is perfectly evident. Suppose you had a tube like that (indicating), with an internal piece like that. You magnetise with a coil on the outside. The lines of force have got to get to the outside and then go through to the central piece here. From the outside piece they have a complete circuit around, so that when the experiment is carried out in this way of course the outside piece will be magnetised more than the centre. But when you bend them around, so that the two ends come together, it is equally easy for the magnetic circuit to be completed through the centre as well as on the outside. You can join this up and not have an opening at all, so that the lines of force could go around there. It is the same: it is merely a matter of tracing the whole circuit.

Prof. Forbes: I venture to say that even in this case the magnetism of the central rod could not be the reverse of the outer tube. From what Prof. Thompson has said, I think I know the whole difficulty. He has magnetised his tube and then taken away the magnetising force, and afterwards tested it. It is perfectly well known that magnetism may be reversed in that case. De la Rue showed that in 1836; it is in his book. But as long as you do not take away the magnetising force it is not so.

Mr. Elihu Thomson: I remember reading an observation which bears on this subject. I think it is by a German physicist. He states that where you use a broad, large coil of large diameter, and put a short piece of steel in the interior, that, singular to state, that piece of steel becomes permanently magnetised in an opposite direction from what you would suppose. Whether it is so or not, I do not know. I thought at the time that perhaps the explanation might be found in this manner: That treating the magnetic field as a closed circuit of lines of force, the very great density of magnetic force in the wire may at times recoil on itself and close through, though that seems to revert to the influence of the magnetising coil in its action.

Prof. Silvanus Thompson: Prof. Schuster has recalled to my memory what I had forgotten, that quite recently Mr. Hughes made some experiments on the concentric tubes. He magnetised them, and then dropped them into acid, and found the insides of the tubes were reversed.

Prof. Anthony: I would like to say a word with regard to one or two of these points. As I understand Prof. Thompson, his statement was with respect to the use of the flat core of this section in place of a round core containing the same quantity of iron, and that in the case of a round core it did not require the same amount of magnetisation. I should like to know if I am not right in supposing that it was demonstrated long ago that the interior of a round bar of iron was of very little advantage to the strength of the magnet, and we may take out of the interior one-half or two-thirds of the diameter, and retain about the same strength of magnetism in a bar as though the mass were a solid bar. Am I right in that view?

Prof. Rowland: Yes.

Prof. Barker: Prof. Mayer said that the thickness of the shell need be only about one-twelfth of the diameter.

Prof. Anthony: Now then, if the mass of iron be flattened down so as to make it very nearly in the centre, the result is obtained of putting a large part of the iron in the position of doing the best work. But what I wanted to speak of in this connection is an experiment that I tried several years ago with a Gramme machine which was constructed at the Cornell University, illustrating this fact of the self-induction in the machine. We constructed there a machine having a Gramme armature, with the alternate coils connected to the commutator on one side of the machine. The other alternate coils were connected to the commutator on the opposite side. So that you understand that the coils connected with one commutator are sandwiched in between the coils connected with the other commutator. Now, in one arrangement of the machine, the brushes connected with this commutator could be so connected with the field magnets that the field magnets were thereby rendered magnetic, the other side of the armature being used at the same time for producing current for the outside circuit of the machine. Now, supposing this to be used for exciting the field magnets, on closing the circuit by means of a wire of very little resistance, the machine became short circuited; in fact, the whole magnetism of the machine would run down in about one-fourth of a minute. I could explain it in another way than that as these coils were passing the neutral point, and the current in the various coils connected with this armature—this current was of course, a very great current in consequence of the machine being short circuited—as these coils passed by the brushes and the current is reversed in them they react so strongly upon, the coils connected with the other side of the machine with which they are in close juxtaposition that they completely destroy the current which is in the magnet, and run down completely the magnetism of the machine. That self-induction, of course, must occur as the machine is in use the ordinary way with all the coils connected up. It amounts to the same thing. Prof. Thompson says it is mutual induction and not self-induction. But each one of these coils acts upon its neighbour in the same way, as I understand it, when it forms a part of the same circuit.

Prof. **Rowland**: I am very glad that that point of hollow magnets has been brought up, as I think that it causes more difficulty, especially to practical men, than almost anything else; the question of hollow lightning rods and a great many other things. I think it can be explained in a very few words. Suppose you have a hollow bar having the magnetised coil around it acting to send lines of force along it in this direction. (Indicating.) They have got to have access to the air; they have got to go out to make their complete circuit. You cannot have them end at any point; they could only end at a certain point if we had free magnetism, that is, a separate magnetic fluid. I speak not from a physical sense, but from a mathematical point of view. If the iron is solid they go around in this way; we can trace them out. The principal resistance to the propagation of these lines of force is in the air outside, and not in the magnet; and if even we take away a large portion of the interior of that magnet we will have the surface the same as it was before, and consequently the external resistances are the same. We have taken away the inside which was not needed. Therefore, in such a case as that, if we remove the internal part we leave the magnet about as strong as it was before. But that would not be the case if we compressed magnetism into that until we get it up to the point of magnetisation of the centre-piece. In that case we should need the whole mass. It is almost impossible to magnetise to any extent without finding a point in which the centre comes in, even with a moderate magnetising force. It depends on the length of the bar. If you bring the bar around, making a complete magnetic circuit of the thing so that the lines of force do not have to pass out into the air at all, when you put a wire around it so as to wind it like a ring at every point, in that case the whole cross section becomes equally magnetised, if it is not bent too much. If it is a large ring of small cross section, it is perfectly magnetised across from side to side. We know that perfectly well; it is a law of the conservation of energy. It is nearly uniformly magnetised across. The case of dynamos is like that. We require the whole cross section to transmit these lines around; here (indicating) they pass across this opening. The resistance to the magnetisation comes partly from this opening and partly from the iron. We have no gain in making these cylinders hollow; indeed, we rather increase the outside forces and let them flow out into the air. In the case of a dynamo machine, the solid form is not only desirable, but by far the most efficient. I am very glad this point came up, because perhaps you will get the idea of how I think upon that matter. I have thought of that matter a great deal, and experimented upon it. Indeed, this closed circuit is the very idea from which the permeability of the iron is determined; and in determining that you have of course to calculate the cross section. All the calculations upon that subject are based upon that law. I think there can be no doubt that in the dynamo the solid form is the proper form, and that the whole cross section is effective. The whole cross section of a round piece is just as effective as the whole cross section of a flat piece. The flat piece exposes more surface to the air, and there is more surface for the force to escape from. That is another reason for not making the magnets flat. The round form is that in which there is the least surface, and therefore the least liability of the lines of force to escape. You can conduct the lines of force by a round piece to any point you desire much better than by a flat piece.

Prof. **Silvanus Thompson**: I want to call Prof. Rowland's attention to another matter connected with this question of very heavy solid iron cores, that perhaps he may not know. There are certain objections urged by practical electricians to the use of these very heavy iron cores which come from quite another source. It is that the machine takes such a long time to charge itself with magnetism. It takes a certain time to magnetise a solid magnet. I have a large electro-magnet in my laboratory, and it takes the magnet ten minutes to get up to its full power when the magnetism comes into play, owing to the slowness with which it takes up magnetism. That is held to be an objection; it is objected to by those who want to build self-regulating dynamos in which the magnetism of the magnet is required to change instantly. If you want to work partly with shunt and partly with series, however perfectly you balance the number of turns of wire, you do not get what you want, unless the iron is divided into masses for the currents to get quickly upon it. Therefore they don't like these solid iron cores for compound dynamos.

Prof. **Rowland**: I do not know that the theory bears upon the solidity of the core. Of course the more iron you get in there the better is the efficiency of the machine. And I suppose there would be no objection to dividing that cylinder up into a number of terms so that the Foucault currents could not exist when you put on the magnetising force. I do not suppose there would be much objection to that if the exterior form was round; but I do have an objection to making it any other shape. Induced currents could be more thoroughly eliminated by dividing up the cross sections more perfectly than by making it even of a very elongated form.

Mr. **Elihu Thomson**: I do not agree that those induced currents can be abolished by dividing up the cores. They can be merely transferred to the wire circuits. The result will be to develop a powerful current in the wire circuit, which will prolong the action beyond the time the solid iron cores would. There is another objection that is made to heavy iron cores. These external currents developed by these cores may set the machine into a constant state of vibration. That is, you have lamps which are adjusted into an arc circuit, and the machine starts on a closed circuit with the carbons in contact. Before the electromotive force has come up to the proper point the field has become over-saturated or over-magnetised, and the result is that the arcs go beyond where they should go. As the machine goes on in its revolution the result is it cannot sustain that magnetisation, because the field is not supported by the same current as at first; the extra current fades away slowly, the carbons go down and shorten the arcs, and a very sudden change of resistance takes place, and the result is a constant trembling of the arc. That difficulty was met in the early development of the Brush machine, and it was overcome by putting a closed circuit of copper around the field. At the same time I had worked at the same method of overcoming the fluctuation. It can be overcome in another way, that is by limiting the amount of iron. In an arc lighting machine we can get rid of this bad effect in most cases.

Prof. **Rowland**: I don't like to rise so often, but I think there is some misapprehension. I have not said anything about large masses of iron. I suppose you have to use the same masses of iron in my method as in any other. The only question is as to making them round or elongated. Of course, as Mr. Elihu Thomson has stated, by dividing this core up it becomes similar to a core of the Ruhmkorff coil, and the currents change very rapidly. From Mr. Silvanus Thompson's remarks I thought that that was desirable, therefore I suggested it. One seems to think that it would be more desirable to have it take a long time, and the other a short time. I cannot accommodate both.

Prof. **Elihu Thomson**: This is simply making a jest of my remarks. You transfer the currents to the wire, and you support a field longer than it could be supported by the extra currents developed in the wire. Mr. Silvanus Thompson mentioned the fact that makers objected to this introduction of a mass of iron in which circuits could flow and retard the magnetisation. I could say that by separating up such a core as that you have probably introduced in compound machines at least these extra currents in the wires of the machine itself.

Prof. **Rowland**: If the time is short then the force must be very great of course; you cannot help that. If the time is long the same current is spread over the long time, and there is less electric force. One cannot say that the current is transferred from the core to the outside. The same current might take place, and, if the resistances are the same, would take place, from the outside in both cases. By lengthening the time of action you decrease the electromotive force and decrease the external current. If the time is ten minutes you would have one electromotive force for the external current; if it is five minutes the electromotive force would be somewhere near twice as great as before. The whole quantity of electricity which would be passing would be the same, however, in both cases.

Mr. **Keith**: In the machine which I have described, and which is a shunt-wound machine, there is a constant difference of potential sustained at the terminals, whether there be one lamp in circuit or one hundred. The result is this:—The magnetic field is constantly of the same strength; there is scarcely any perceptible variation. The speedy rise and fall of the strength of the magnetic field which is desirable in arc lighting does not prevail in incandescent lighting when the machine is so constituted as to be one of constant electromotive force. It is desirable in such machines to have a mass of metal which does not suffer speedy magnetic changes of any kind. This has been arrived at as the result of experience, as well as from theoretical considerations. I have a machine running for electro-metallurgical purposes, producing a current of a thousand ampères with three volts of electromotive force. This machine has a large mass of iron in its magnets. The magnets are exceedingly long and made of a pattern which is well known. This machine takes from thirty to forty-five seconds to arrive at say 90 per cent. of its maximum working intensity of field. There is, after that, a gradual rise in this intensity extending over a period of five minutes or thereabouts. This is also a shunt-wound machine. If we break the circuit to the field magnets, the current prevails in considerable strength, dying gradually away for about twenty-five seconds from the time of the breaking of the circuit. This construction is desirable for steadiness of current, where steadiness of current is desirable; but it is not desirable under conditions where we need to change the electromotive force, as in arc lighting.

Prof. **NIPHER**: It occurs to me to say a few words in regard to an unfortunate machine which has been referred to several times, and which I saw the other day for the first time. It has two armatures and only two pole pieces. I was as much astonished as anybody could be when I saw it, but when I was informed that it weighed less than one thousand pounds and maintained a high strength of current, I thought it worth while to investigate what the machine would do before we said too much about how it worked.

## THE ORGANISATION OF THE POST AND TELEGRAPH SERVICE IN FRANCE.

(*Concluded from page* 476.)

*Conferences on Electrical Units and the Protection of Submarine Cables.*—The French Government hastened to comply with the wish expressed by the congress. All the different States convened replied to the invitation that was forwarded to them by the Minister of Foreign Affairs.

On the 16th October, 1882, the two conferences, the meeting of which had been requested, were opened at the same time in Paris, and divided the study of the questions which were reserved to each of them.

The first conference, called the conference of the electrical units, was to occupy itself specially with the electrical units, and generally with the three first questions proposed by the congress.

In its first meetings the conference recommended certain methods to be used in order to determine, in a definitive manner, the standard of electrical measurements and the standard of light. But, because of the nicety of the experiments that had to be made, it was not able to adopt immediately a final resolution.

It decided that the tests should be made under conditions agreed on by the conference.

As regards the questions relating to atmospheric electricity and storms, the conference has requested the different telegraph administrations to give it their co-operation for that purpose.

Thanks to the money voted by the Chambers for the meeting of the conferences, the experiments already begun have been carried on.

The conference met again on the 29th April, 1884, and its labours ended in valuable results for electrical science.

In the first place, the units of electrical measurements, known in the science under the names of "ohm, volt, and ampere," and the unit of light have been clearly defined, so as to represent everywhere the same absolute value. In the second place, the conference has recommended the establishing of standards conformably to the given definition. Finally, it has requested the International Office of Berne to be so kind as to bring together the results of the experiments on electrical circuits collected by the telegraph administrations. The mission of the second conference was to assure the protection of submarine cables, and to introduce in the international law arrangements for that purpose. Indeed, submarine cables are frequently interrupted. Considerable interests suffer thereby; political and commercial relations are impeded by it. These interruptions are often due to neglect, and occasionally to real maliciousness.

Sometimes cables are hooked by an anchor, and rather than lose this, except to obtain repayment for it from the proprietors of the cable, the captain of the ship cuts the cable. Sometimes the accident is due to the nets of fishermen.

Various circumstances always caused a settlement of such unquestionable usefulness to be put off. Since 1863, a convention was signed by different States for the purpose of protecting an international cable they intended laying; but as the undertaking did not come to anything the convention was not applied.

In 1869, the Government of the United States, in its turn, took the initiative of a conference to discuss the questions relating to submarine cables. Its proposals were favourably received, but unforeseen circumstances, nevertheless, prevented their being carried out.

The Conference of the Telegraph Union, held in Rome in 1872; the conference held in Berne in 1880 for the codification of the right of people, the congress of electricians, the conference of the Hague for the making of regulations as regards fishing, all expressed the wish that cable property should be protected.

All these meetings, however, had to acknowledge themselves incompetent, by proclaiming the importance of the work to be realised.

The necessity, however, of protecting the submarine communications which connect the different nations, and of granting to cables the security which will allow of extending their network and of lowering their tariffs, became more and more apparent.

The meeting of the conference of 1882 was the means of attaining the proposed object. The delicate questions of responsibility, competency, jurisdiction, have been settled to the best of the general interests.

The members of the conference separated on the 2nd of November, 1882, after having adopted the project of a convention laying down the principles which should reconcile the engaged interests. The basis of this project, its principal stipulations, have everywhere been accepted at once.

Only a few remarks have been made concerning some minor points.

The conference had to meet again, on the 16th November, 1883, to settle these latter difficulties.

More countries have shown their adherence by sending representatives to take part in the work of the conference, at which 32 governments have been represented.

The final project of the convention was unanimously accepted by the delegates, and each of them undertook to endeavour to obtain the approval of it by his government.

This approval has been obtained.

This official signing of this convention, which henceforth will take its place amongst the international laws, took place in Paris on the 14th March, 1884.

It allows in its principal resolutions:—

1. The recognition of the principle of punishment for any breaking or damaging of a cable, either done wilfully or through culpable neglect, without prejudice to the civil action for damages.
2. The establishment of the right that any proprietor of a cable can claim the repairing of any damages during the laying or repairing operations of another cable, and which operations should have caused the breaking or the deterioration of the one of which he is the proprietor; and, further, that the owners of ships should be indemnified for any loss caused through sacrificing any gear belonging to them, and made for the purpose of not damaging a submarine cable.
3. The conferring of competency to the courts of justice by the country to which the ship belongs, on board of which the infringement has been committed.
4. The indication of the admitted means of evidence and of the competent authorities to draw up a *proces-verbal*.
5. The protection of the ships employed in the laying and repairing of cables.
6. The obligation of the contracting governments to take or to propose to their respective legislatures the necessary measures to assure the execution of the convention.

The success of the International Electrical Exhibition of Paris has called forth similar undertakings in other countries, coming more or less near it, but nearly always under more limited conditions, and of a private character.

We should mention, however, apart the exhibition which took place in Vienna in 1883. The first idea of this exhibition was due to private initiative. The success of the exhibition of Paris, no doubt, is not foreign to this enterprise, to which the Government of Austro-Hungary granted its patronage. This success we have owned, to a great extent, to the eagerness with which the European Administrations—and, in the first place, the Administration of the Austro-Hungarian Telegraphs—replied to the invitation that had been sent to them in 1881 by the French Government.

The Austro-Hungarian Government, having officially invited the different telegraph administrations to take part in the exhibition of Vienna, France was the first to reply to that appeal, and the Chambers voted an extraordinary credit of 80,000 francs, to allow the ministry of Posts and Telegraphs of being worthily represented at it.

France occupied an important place at the exhibition of Vienna. It counted 140 exhibitors on a total of 600, and her exhibitors took up 400 square metres, or the third of the whole exhibition.

Our exhibition has been the subject of the most flattering testimonials, and we may consider that it has been a real success to the French administration and to the French manufacturers who have taken part in it.

In concluding this statement of the transformations which during six years have taken place in the post and telegraph administrations, we can compare with satisfaction the present state of this service with that in which it was previous to 1878. On the one side, the postal and telegraphic traffic in France was less than that of the greater part of the principal European nations; the rates were higher; we were behind other countries; a reform was indispensable to raise us from that inferiority. On the other side, the power to act was required to satisfy the legitimate wishes of public opinion; the staff insufficient, badly paid, overworked, succumbed—notwithstanding its devotedness—under the weight of its task; the service, stretched to the utmost, was about to be exposed, and the reports of the former director-generals, which we have mentioned in this statement, show plainly the extent of the evil.

The first remedy to this state of affairs has been found in the fusion of the two services and the mutual co-operation which officials could give each other, who previously acted separately; the economy which thereby could be realised has allowed of supplying larger offices for the work, and better suited for the purpose. We have, at the same time, asked for and obtained the necessary credit to strengthen the service.

The staff was particularly worthy of all the anxiety of the Government. It was more than time that they were encouraged, and that they should understand that we, at last, intended to occupy ourselves with their legitimate interests. We have increased to a considerable extent the number of officials, as well as that of the post and telegraph offices. In one word, we have given to the service in all its branches new means for working, which were absolutely necessary.

[After recapitulating the various improvements that have been made, and which have been fully described in our columns, the report goes on as follows :]

Our post and telegraph service can at present bear comparisou with that of the neighbouring countries.

Notwithstanding the expenditure, which it has required to raise it, it is at present, after the English service, the one which yields the most important net product.

For 1882, the last statement of receipts and expenditure in which we know the results for the foreign countries, it reaches the figure of 31 millions; and if the figure, given by England, amounts to 75 millions, we should take into account: 1, that the receipts of the English post office savings' banks, included in those of the post office, exceed by 3,600,000 francs the corresponding expenditure; 2, that the expenditure for the mails only figure in it to the amount of 16 millions, as the other subventions are paid by other budgets, whilst in our country they amount to nearly 27 millions; 3, that the budget of the post office does not include certain expenditures which we have to meet; its receipts, moreover, contain some elements which do not enter into ours. As regards Germany, although she is not burdened with our expenditure for maritime subventions, the net product does not amount to 30 millions and in the other countries it does not reach 10 millions.

Now if we compare our inland rates with those of other countries, we find the following :—

1. That the postage of single letters amounts to: 10 centimes in England, Belgium, Switzerland, Luxemburg, Servia, and the United States; 10⅖ centimes in Holland; 12 centimes in Denmark; 12½ centimes in Germany and Austro-Hungary; 13¾ centimes in Norway; 14 centimes in Portugal; 15 centimes in France, Bulgaria, and Roumania; 17 centimes in Sweden: 20 centimes in Italy; 25 centimes in Spain; 28 centimes in Russia.

2. That the price of postcards amounts to: 5 centimes in Austro-Hugary, Belgium, Bulgaria, England, the United States, Luxemburg, Roumania, Servia, and Switzerland; 5⅕ centimes in Holland; 5½ centimes in Portugal; 6¼ centimes in Germany; 7 centimes in Norway; 8 centimes in Sweden; 10 centimes in France and Italy; 12 centimes in Russia; 20 centimes in Spain.

3. That the minimum rate for printed matter amounts to: 8 centimes in Russia; 6 centimes in Denmark; 5 centimes in England, Austro-Hungary, the United States, Sweden, Bulgaria, and Servia; 4 centimes in Norway; 3¾ centimes in Germany; 3 centimes in Roumania; 2 centimes in Italy and Holland; 1 centime in France.

4. That the average price of a message of 15 words, amounts to :—

1.70 francs for the 1st zone in Russia; 3.47 francs for the 2nd zone in Russia; 14.80 francs for the 3rd zone in Russia; 1.40 francs in Sweden; 1.25 francs in England; 1.20 francs in Roumania; 1.18 francs in Austro-Hungary; 1 franc in Spain, Italy, Portugal and Servia; 83 centimes in Greece; 75 centimes in France; 66 centimes in Denmark; 63 centimes in Germany; 60 centimes in Holland and Belgium.

Thus the postage of single letters for the inland service, which in France is lower than in Sweden, Italy, Spain and Russia, is still higher than in England, Belgium, Switzerland, Luxemburg, Germany, Austro-Hungary, Norway, Portugal, Holland, Denmark and Servia.

The price of post cards is also higher than that in 14 other countries.

As regards the price of inland telegrams, the comparison with other countries is favourable to us; in certain countries the messages are rated per word, with a minimum of a fixed amount; several add to the chargeable rate, obtained from the number of words, a fixed rate, called constant; in other countries the rate is calculated per word, without constant or minimum; finally, in some of them it is calculated per series of 10, 15 or 20 words.

Because of this diversity of systems, it is indispensable to take a basis for comparing them; the rate of a message of 15 words, the average length of a telegram, is generally the accepted basis. Under those conditions our rate is only higher than in four countries—Switzerland, Denmark, Belgium and Holland, in which the system, being spread over a much more limited territory, involves, of course, much less expenditure. Besides, for a message of ten words, two of those countries, Switzerland and Denmark, charge higher rates than we do.

Our tariff for a message of that number of words is, therefore, the lowest of all.

**The Telephone in Venezuela.**—The Inter-Continental Telephone Company, operating under exclusive government concession in Venezuela, now has exchanges established at Caracas, Da Guayra, Valencia, and Porto Cabello, aggregating nearly 500 subscribers. It has trunk lines connecting Caracas and Da Guayra, Valencia, and Porto Cabello, over which a very large business is done. The exchanges are remitting surplus receipts to the Boston office already, and the net earnings in 1885 are expected to exceed 10 per cent on the entire capital of the company.

## THE PHILADELPHIA ELECTRICAL EXHIBITION.

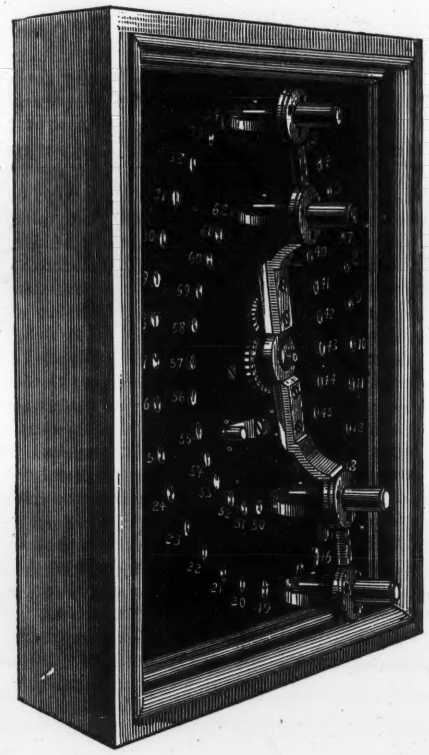
### FOURTH NOTICE.

United States Electric Lighting Company.—In this company's exhibit were to be found two special machines constructed to generate current for 50 lamps, each of 125 candle-power. Also three sizes of machines for 175, 300 and 600 incandescence lamps respectively of 16 C.P. The tendency of late in manufacturing these machines has been to obtain higher electromotive force by using a longer armature of smaller diameter with a special winding; the 600-light machine at 850 revolutions gives 120 volts and 300 ampères, or about 50 H.P. electrically. Arc light machines are made of four grades, namely, for 5, 10, 20 and 50 lamps each. An addition has also been made to the arc lamps in the shape of a cut-out, so that on the arc becoming unduly lengthened, from any cause whatever, say, from a ¼ to ½ an inch, that lamp is automatically cut out, and remains cut out, of circuit until attention can be given to it. The company uses two kinds of incandescence lamps, those of 16 C.P. and others of 125 C.P. The former has when cold a resistance of about 400 ohms, and requires 116 volts and about half an ampère; and the latter kind has a resistance when cold of 125 ohms (when hot, about half that resistance), and requires 150 volts and about 2½ ampères. The filament, which is zigzag in form, is made of a substance called "tamadine," prepared from gun cotton, by dissolving it in a similar way as in the making of collodion. It is then moulded into thick sheets and afterwards cut into thin ones, and finally soaked in a solution of sulphide of ammonia, which brings it back to the state of pure cellulose. In order to get a substance as devoid as possible of any texture, and homogeneous throughout, the material is then rolled out into still thinner sheets; the loops, in a wavy shape, are then punched out in a die and the carbonising is then done in an ordinary muffle furnace. There were also exhibited two motors and the Weston form of the Clark standard element. This consists of a glass bottle with a tightly-fitting hollow stopper. A platinum wire sealed into the stopper, carries a piece of pure zinc, which projects below the stopper into the main cavity of the bottle. To prevent any local action between the platinum and zinc, the cavity of the stopper is filled in with paraffin. Close to the base of the bottle another platinum wire is sealed in, which makes connection with a layer of mercury. On the mercury rests a stratum of pure mercurious sulphate, and the rest of the bottle is occupied by a solution of pure zinc sulphate having a density of 46·5° B. at 27·6° C. The volume of the solution is so large and its density so great (though saturation is carefully avoided), that its condition always remains practically the same. It is claimed that in this manner a cell of constant electromotive force is produced with a comparatively low internal resistance.

Western Electric Company of Chicago.—This company, which, by the way, has recently established an agency in London, had a very extensive exhibit, and their instruments appeared, in every instance in which we examined them, to betoken great care and finish in manufacture. There were displayed relays, galvanometers, resistance coils, bells, switches, thermostats, batteries, and wires, &c., of the usual kinds; also telegraph keys, district telegraph instruments for fire and police alarms of the patterns peculiar to American makers were shown, and many other specimens of apparatus too numerous and too well known to require description here.

One thing in this exhibit needs, however, more than a passing mention, namely, a fire alarm for hotels, &c. (See fig.) It is intended in case of fire to alarm the occupants of every room in an hotel in the short space of about half a minute, and consists of two rows of pushes arranged in circles, each push capable of making circuit with a bell and battery, one of the former being in each room of the hotel or other place where an alarm may be needed. A cross arm, actuated by a coiled spring, extends over the pushes, and has at each end two rollers, which press as the arm revolves on the pushes before mentioned. Thus four contacts are made at once, and as the half revolution of the arm is made in a few seconds, the whole of the contacts are made in a short space of time, and the desired alarm given. It is obvious that any number of pushes may be worked and the time of the revolution adjusted as desired. The actuating spring is released mechanically by the switch shown in the lower part of the figure.

We think such an alarm may be of great use, not only in hotels but in large buildings where there are many dormitories, such as orphanages, hospitals, &c. Such an invention would have been of considerable service in such an accident as that which befel some of the members of the British Association near Montreal this autumn. A fire broke out in the middle of the night on board a steamer which was moored to a wharf awaiting the daylight. So rapidly did it spread that those sleeping at the stern portion of the boat only awakened to find themselves shut in between fire and water. Only by the tact and energy of the purser was a terrible disaster to life avoided, but had such an alarm as that described above been used not only would the safety of lives have been far more sure but the considerable loss of property would have been avoided. The Western Electric Company also exhibited their capital multiple switch board, described in the ELECTRICAL REVIEW of October the 18th last.



## New Post and Telegraph Office in South Australia.—

A fine new post and telegraph office has just been opened at North Adelaide; the formal ceremony was to have been performed by the postmaster-general, Mr. C. Todd. C.M.G., but was dispensed with in consequence of that gentleman's severe indisposition. There appears to be no telephone exchange at North Adelaide, but a single instrument is provided at the new building, "which will probably form the nucleus of an exchange at no distant date."

## NOTES.

**Electric Lighting.**—The Liverpool Electric Supply Company is now supplying the electric light from the central station in Liverpool to two large hotels, three theatres, and some extensive business premises, several hundred incandescent and some arc lamps being employed for the purpose. The company is also lighting the large ball-room and other rooms of the Wellington Club with 200 incandescent lamps. The Corporation of Liverpool has given the order to the above company for the electric lighting of the Free Library and Picton Reading Room. During the past year many installations have also been carried out for private customers. Messrs Holmes & Vaudrey are the managing directors of the Liverpool Electric Supply Company, and the above work has been carried out under their personal supervision.

Mr. Ellis Lever, of Bowdon, Cheshire, the father, we believe, of Mr. Charles Lever, of arc lamp fame, writes as follows to the *Morning Post*:—"The attempt to blow up London Bridge and other similar attempts to wreck property and destroy human life point to the necessity for the better lighting of the metropolis, and particularly of the bridges, stations, and other public buildings in the more central parts of London. Had the arches of London Bridge been properly lighted, there would have been no difficulty in perceiving that a number of men were engaged or about to engage in a suspicious proceeding, if, indeed, any such diabolical business would have been attempted, had there been a good light on the river. The City Corporation and other authorities in London and elsewhere should remember that darkness and danger go together. The converse is equally true, where there is light there is safety. These men must not be permitted to accomplish their wicked designs under cover of darkness. It appears to me that it is the bounden duty of the local authorities in the metropolis to do all in their power to prevent the possibility of further attacks of this kind; and also to give a greater sense of security to the inhabitants. More light means this, and the electric light far supasses any other for the purpose."

Mr. W. H. Massey writes to *Engineering* upon the subject of lighting trains by electricity:—"As you have thought well to refer to the trials which took place about a year ago on the District Railway, perhaps I may be permitted to state once again that the plan of putting machinery of any kind into a van was not recommended by me, and that I have always advocated the use of a separate engine placed on the locomotive, an arrangement which Mr. Woodley was not inclined to adopt when he first went into the matter. This is the only practicable scheme for lighting trains *on a large scale*, and the sentimental objections at present raised to the lights being extinguished, whenever it may be necessary to disconnect the locomotive engine, ought not to weigh with those who know from experience that it makes little or no difference in well-lighted stations whether the carriage lamps are lighted or not; at any rate, secondary batteries are not yet perfect enough, nor cheap enough, to allow of their being placed under the seats of every carriage, and, until they are, there is no probability of their being employed to any great extent, except by inventors of systems which, as I have shown elsewhere, are of no earthly use without them. I have no pecuniary interest in any of the methods hitherto proposed, so there can be no harm in my calling attention to the fact that the cost of fitting up a long train and its locomotive with electric light machinery is but half that of putting in gas apparatus, and also that, by the evaporation of about 200 lbs. of water, 50 incandescent lamps, of 20 candle-power each, may be kept lighted for one hour; but when I tell you, sir, that I *have* come across railway people who did not even know that 'the weight of water had anything to do with the question,' you will understand why I am so anxious to secure your help."

Peterhouse College, Cambridge, the sexcentenary of the foundation of which was celebrated on Monday, is the first college which has adopted the electric light. It owes its introduction to the exertions of Sir William Thomson, who, at his own cost, has supplied the necessary apparatus. Not only are the courts of the college, the hall, combination room, and chapel, lighted by electricity, but the rooms of the undergraduates and the master's lodge as well.

Mr. James Laing heads the list in the shipbuilding returns for the Wear for the year 1884, having built 11 vessels of a gross tonnage of 20,805. Three of these vessels have been fitted with the electric light—the *Funchal*, the *Esteban de Autunano*, and the *Trinidad*.

Referring to a leading article on "Electrical Units" in a contemporary, in which it is stated that at the present moment there is not in the whole world 10,000 indicated horse-power used in the production of electricity, Mr. M. A. Miller, C.E., of Newark, N. J., writes:—"I should like to state that in the United States alone there is a greater amount of steam power used for electric lighting than four times the number of indicated horse-power stated. I can prove that but one of the leading electric light companies of the States, viz., the United States Electric Lighting Company, using the Weston systems, has arc and incandescent lights and dynamo machines running which use—

| | | |
|---|---|---|
| For the city of New York—three stations ... ... | | 2,000 H.P. |
| Independent plants, including Brooklyn Bridge | | 1,000 „ |
| In different parts of the country, independent plants ... ... ... | Arc lights ... | 5,000 „ |
| | Incandescent lights ... | 5,000 „ |
| Local stations at Boston, Manchester, Providence, Newport, Rochester, Newark, Philadelphia, Baltimore, Washington, Charleston, Toledo, Ohio, and many other places ... ... ... ... | | 10,000 „ |
| Making a total for one electric lighting company alone of ... ... ... ... ... ... ... ... ... | | 23,000 H.P. |

That this statement is rather below than above the actual number of horse-power used for the Weston systems may simply be proved by the fact that there have been built up to the present time more than 2,000 Weston dynamo machines, requiring in the average each about 10 horse-power. The United States Electric Lighting Company has formerly also built about 500 Maxim machines, absorbing about 6 horse-power each, giving thus a total number of horse-power as stated above. Taking the Edison, the Brush, the Thomson-Houston, and half-a-dozen other electric light companies into consideration, I think 40,000 horse-power, used for electric lighting purposes in the United States alone, would rather be a low estimate than otherwise."

We understand that Mr. William Whiteley, of Westbourne Grove, has purchased the 1,000-light Ferranti machine which was recently exhibited at the Health Exhibition, and which obtained the gold medal. It is interesting to know that the machine of this same type exhibited last year at the Fisheries Exhibition was also purchased; in that case by the South Kensington Museum. Mr. Whiteley, we learn, is not trying the Ferranti machine for the first time, but has had a small 200-lighter actually running 350 incandescent lamps, and, notwithstanding the severe test, the machine is still in good order.

Writing in the *Journal of the Society of Arts*, Mr. F. H. Varley says:—"Many points of vital importance await the light of critical discussion before anything like uniformity can be arrived at in the carrying out of practical installations. This is manifest from the fact that in the discussion on Mr. Preece's valuable paper, in which only four speakers—including the chairman—took part, such great differences of opinion existed not only on the American systems of electric lighting, generally, but also on such definite points as the reliability of Edison's electro meter, and the comparative merit of high and low tension currents. There can be no doubt, as Mr. Preece said, the measurement of electricity by the electro-deposition of metals, as used in the Edison meter, is scientifically correct, and in every way well suited to the laboratory; but as a meter for practical use, it is very defective in that, not being a self-recording instrument, it cannot be read by the unskilled consumer. I have given considerable attention to this part of the subject, and, in conjunction with Mr. J. R. Shearer, have brought out a meter which removes the whole of the difficulty. In its simplest form it consists of a hydrometric float carrying an electrode, and graduated to indicate the amount of current passed by the electro-deposition and dissolution of metals. The other electrode is attached to the containing jar. It is, therefore, both scientifically accurate and perfectly practicable. The high and low potential question has now reached a point analogous to what in railway matters was termed the "battle of the gauges," the high potential corresponding to the narrow, and the low potential to the broad gauge; and I have no doubt it will terminate in a similar way. For local or limited installations, such as the lighting of the Royal Courts of Justice, the low potential system has the charm of simplicity; but for lighting from central stations the economy is entirely in favour of the high potential system. Under the latter the output at the dynamo can be doubled with but slight increase in its cost; but the great economy under it is the enormous saving in the cost of leads, as the same sectional area of conductor with twice the potential will do double duty. It is to be hoped the Government will be wise enough to repeal the sections of the Electric Lighting Act, which render the use of low tension currents compulsory; for if these sections are repealed, the same equivalent of light could be obtained at from one-fifth to one-half the cost, and there would be no necessity for converting our streets into veritable copper-mines. I do not agree with Mr. Preece and Mr. Hammond that electric light need now be more expensive than gas, nor in any sense a luxury. For domestic lighting it is not necessary to adhere to the incandescent system; small arcs of from 80 to 100 candle power, requiring a current of about 120 watts, are much more economical, and when the electrodes are made of flexible carbon these lamps require very little attention. We entered a lamp of this description for the International Health Exhibition, but, unfortunately, could not get it completed in time for exhibition. It is now complete, and will soon be before the public."

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**The Proposed Contest of Telegraphists.**—According to the *Telegraphist* the proposed competition between British telegraphists, the second of its kind, has been abandoned. This determination would appear to have been come to in consequence of a letter written by Mr. Patey, one of the secretaries of the General Post Office. It may be remembered that, through the kindness of the engineering department, a Wheatstone receiver was lent for the use of the competitors at the first contest last February, and the concession was highly appreciated by the telegraph clerks of the country. When the application was renewed a few days ago, the following letter was received from Mr. Patey:—"General Post Office, London, December 12. Sir,—With reference to your letter of the 8th inst., addressed to the engineer-in-chief, asking for the loan of certain telegraph instruments for use in connection with a proposed competition of British telegraphists in February next, I beg leave to acquaint you that this department is not prepared to lend any instruments for such a purpose.—I am, Sir, your obedient servant, C. H. B. PATEY. Mr. W. Lynd." An appeal has been made to the Postmaster-General with a view to having this resolution reconsidered, and, failing a reply satisfactory to the telegraphists, an agitation is proposed to be set on foot against the action of the department in the matter.

**Launch of a Cable Steamer.**—Messrs. R. Napier and Sons, Govan, launched on Friday, the 19th inst., a screw-steamer named the *Magneta*. The new vessel, which is 230 feet long, 32 feet in breadth, and 24 feet deep, is built of steel in excess of Lloyd's rules. The owner is the Eastern Extension, China and Australasia Telegraph Company, and the vessel is intended for the laying, picking up, and repairing of its submarine cables. Mr. Birnie, of London, has designed the vessel, which, besides having the usual steam appliances of merchant ships, has numerous tanks for holding cables, stores, fresh water, and for trimming and ballasting the vessel. There are 27 water-tight compartments in all. On the main deck is fitted Messrs. Johnson and Phillips's laying and picking up gear, which is driven by a pair of powerful independent engines. The ship is ventilated throughout by steam and lighted by electricity. A powerful search-lamp is fitted on the bridge. The vessel has compound engines and boilers supplied by the builders, and will steam at a rate of 12½ knots. She will be delivered on the Thames in complete working order within 6½ months from the date of order.

**In re the Provincial (Brush) Electric Light and Power Company, Limited.**—A petition was presented on Saturday, the 20th inst., by the above company for the sanction of the Court to a resolution recently passed for a reduction of the liability upon those shares of the company which have been already issued. It was proposed to reduce the nominal amount of the shares from £5 to £2 15s., but to leave the nominal amount of the unissued shares unaltered. An inquiry has been made in Chambers, with the result that there were only seven creditors. Of these three have been paid, and the other four consented to the reduction. Mr. Justice Pearson sanctioned the proposed reduction, and directed that the company should use the word "reduced" as part of its name for a month.

**Sale of Lumley Dynamos.**—A sale by auction, announced in our advertisement columns, is worth the attention of any of our readers on the look out for bargains, as we are informed that the machines are to be sold without reserve.

**Fires from Belting.**—Herr Boher, illumination inspector of Dresden, has been making some experiments to determine what part is played by electricity in causing explosions of flour dust in mills. His investigations have been conducted at the Royal Court Theatre, where the powerful dynamos for the electric lights are driven by steam power. "Here," the inspector says, "the electricity from the belting is so intense that more could scarcely be obtained in the best electric machines. Leyden jars became charged by this means in a few seconds, so that on being discharged sparks leap one and three-fifths inches. Any person standing on an insulator, and placing the hand within 4 to 6 inches of the moving belts, is quickly charged with electricity, so as to give out long sparks. Geissler tubes, having projecting pointed wire at one end, and metallic connection with the earth at the other end, glowed, when placed near the belts, with beautifully coloured lights. In short, every experiment possible with electric machines can be performed by this belt-developed electricity. At first I thought that the presence of the dynamo-electric machines had a great influence on this phenomenon, but I have noticed the same, more or less shown, in many kinds of factories having steam power. In many flour and meal mills the dust has become ignited without the cause having been discovered. I have now, from experiments, become firmly convinced that electricity developed by belts can cause such disaster. In most factories, other than flour mills, the quantity of metal present, and the arrangement of the iron-framed machines, is such that a connection among them is established sufficient to conduct safely away the electricity. It is, however, different in flour mills, especially where French burr stones are used, which are made of separate pieces bound together by thick iron bands. The latter are not connected with one another, but isolated by the non-conducting stone. Rims, therefore, which are next to the driving pulleys and belts (generally located just below stones when cogwheels are not used, and pulleys almost equal in diameter to the stones) become surcharged with positive electricity—as shown in the Leyden jar, for instance; the next nearest rim or rims will, by induction, develop negative electricity. These opposite forms of force having arrived at a dangerous degree of tension, the leaping of an intense spark from one stone band to another could ignite the excessively inflammable flour dust. To guard against this danger it is simply needful to collect the iron spindles of the stones together by a thick wire, a metallic bar being at the same time located nearly touching both stone rim and driving pulley. In all other industrial works the precaution would be advisable that no isolated ironwork should be near pulleys and belting when combustible materials are also in the immediate neighbourhood." The editor of the *Scientific American*, commenting upon the remedy above suggested, fears it is of little avail, as the connection of the spindles as proposed will not prevent the generation of electric sparks, and remarks that a better prevention is to keep the atmosphere of the apartments where the belts run thoroughly damp.

In a succeeding issue of the *Scientific American* a correspondent wrote:—"We have at present a very marked production of electricity on a pair of elevator engines in a very unfavourable place, it being in a basement of a large warehouse for stoves. This basement is very moist at all times, and the engines are well connected electrically through the steam pipe to boiler and feed pump, and to the ground by water main, also steam traps in the ground, the engines being set on large stone slabs. In spite of this they at all times produce enough electricity to be seen. I have seen sparks 2¼ inches long, this being from the belt to nearest point on the frame of the engine. Another effect is that both kinds of electricity are produced, the electricity being reversed when the engines are reversed. When the belt is running from the lower side of drum-pulley to engine-pulley positive electricity escapes from edge of belt to brake-rod. When the belt runs in opposite direction negative electricity escapes from the frame of engine to face of belt. To judge from the experiment I made, as below mentioned, a moist temperature does not seem to totally prevent the production of electricity. I have brushed the edges and face of belt with a handful of moist waste, after which the sparks were as usual. Even on rainy days I have noticed the sparks to pass the same, when I was not able to produce any with the plate machine. I have no doubt about the sparks setting fire to combustible dust. I have burnt holes through papers of several thicknesses. The sparks are of a very blueish to a yellowish colour, with a loud crack, the passage of negative being most blueish. I notice by running a wire across the face of belt it reduces the size of the sparks, but it did not prevent the production of same. Have oiled the belts with castor oil without producing any change."

## NEW COMPANY REGISTERED.

**Western Counties and South Wales Telephone Company, Limited.**—Capital, £400,000 divided into 20,000 preference shares of £5 each, and 300,000 ordinary shares of £1 each. Objects: To enter into three agreements with the United Telephone Company, Limited, and others, and to carry on in all branches the business of a telephone company. Signatories (who subscribe for preference shares): *Charles Nash, 200 shares; *Mark Whitwell, 100 shares; *Thomas Pole, 100 shares; *H. Fedden, 100; H. F. Lewis, 10 shares; J. Inskip, 10 shares, all of Bristol, and *Commander D. M. Forsyth, R.N., Ryde, 100 shares. Directing qualification, 100 preference or 500 ordinary shares. The first directors are the signatories denoted by an asterisk, and Richard Cory, of Cardiff, and two others, to be appointed by the United Telephone Company. The company in general meeting will appoint remuneration. Registered 17th inst. by Ashurst, Morris and Crisp, 6, Old Jewry.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Self-propelling Motor Syndicate, Limited.**—The statutory return of this company, made up to the 15th inst., was filed on the 22nd inst. The nominal capital is £20,000 in £5 shares. 3,736 shares have been taken up. Upon 427 shares the full amount has been called up, and £1 per share upon the remaining 659. The calls received amount to £2,590, leaving £2,840 unpaid. The total amount of shares for which share warrants, comprising one share each, are outstanding is £3,750. Registered office, 15, New Broad Street.

**Standard Electric Light and Power Company, Limited.**—This company has entered into an agreement (dated 1st inst., and filed on the 20th inst.) with Messrs. John Berger Spence & Co., of 31, Lombard Street, for the purchase of certain letters patent in connection with improvements in electric piles or batteries granted to Felix de Lalande, No. 1464, dated 27th March, 1882. The purchase consideration is 9,600 fully paid shares.

An agreement of even date provides for the purchase from Mr. J. B. Spence of letters patent in connection with improvements in galvanic batteries, and the utilisation of the products thereof, No. 40, dated 1st January, 1884; the purchase consideration is 100 fully paid shares.

## CITY NOTES, REPORTS, MEETINGS, &c.

### The Oriental Telephone Company, Limited.

On Monday afternoon an extraordinary general meeting of the above company took place at Cannon Street Hotel upon a special requisition to the directors, under the presidency of Colonel G. E. Gouraud, chairman af the company. There was a large attendance, and the proceedings were marked throughout by considerable warmth and personal feeling. In the convening notice the objects of the meeting were stated as follows:—"1. To consider the propriety of appointing, and if thought desirable, to appoint, a committee of investigation, to examine into the affairs of the company, with power to inquire into and report upon all agreements effected with subsidiary and other companies; and (2) to increase the number of directors by appointing five additional directors, or any less number, such increase not to involve any increase of the directors' remuneration."

Before calling on the secretary to read the notice, the Chairman said that he should call at once on the gentlemen in whose interest the meeting had been called to move the resolution of which notice had been given.

The Secretary, Mr. W. G. Hall, having then read the convening notice, Mr. Lloyd rose to move the resolution in terms of the Chairman's ruling. He wished, he said, to state briefly the chief reasons which had induced his friends and himself to take the course which had brought them together. Some time ago a committee of investigation had been appointed by the shareholders of the Consolidated Telephone Construction and Maintenance Company, which committee had reported very unfavourably against certain directors of the Consolidated Company, who were also directors of the Oriental Telephone Company.

The Chairman (interrupting) said that if any remarks were based upon that report, it would be convenient to the gentlemen present that that report should be read as a whole.

Mr. Lloyd, continuing, said he did not intend to enter into that report. Only that report involved three out of four of their own directors permanently resident in London; and it seemed to the requisitionists reasonable and proper that they should inquire whether the affairs of the company were being better managed than were the affairs of the Consolidated. (Hear, hear.) He was not assuming the correctness of that report, but it was issued and accepted by the Consolidated shareholders, and the charges brought had likewise been accepted. He hoped it would be found that their own business was properly and well managed. He made no charge; he simply wanted to investigate. (Hear, hear.) He should have thought that the directors, against whom such very grave charges had been brought, ought to welcome the proposal of an investigating committee. (Hear, hear.) The shareholders had no interest adverse to the directors; they were not in the least anxious to find them guilty in any way, but they wanted the affairs of the company looked into before a perfectly impartial tribunal. In their circular report the directors had stated that they had invited the shareholders individually to come to the office and make any inquiries they pleased. Well, at the last general meeting of this company a consultative committee was appointed—Mr. Pender, Mr. Ackers, and Mr. Grewing. The majority of that committee were very soon convinced that the committee was a farce, and it ended in a farce, and consequently both Mr. Ackers and Mr. Grewing had assisted him (the speaker) in the movement of which he was the exponent. Mr. Ackers was the largest shareholder of the company, holding £24,000 in shares, and they would agree with him that that gentleman was not likely to adopt any course that would injure the company. He would like to call attention also to the report of the auditors, which the directors had sent out along with their second circular. He had been struck by the extreme caution of the auditors' language—they had been careful not to commit themselves. Further, they would see how very careful the auditors were about telling them how the paid-up capital had been spent. His own circular (the speaker's) sent out to the shareholders had stated that not only was the paid-up capital all spent, but the directors had borrowed £3,500 from their bankers. The auditors' report had confirmed that (Hear, hear). Of the original £110,000 of paid-up capital, £40,000 went to the vendors, leaving £70,000 to be accounted for. Now they wanted a perfectly independent and impartial committee that would tell them just what had become of that £70,000, and of the £3,500 borrowed besides. They had a right to that investigation (Hear, hear). When the company was brought out, stress was laid upon the fact that India offered a very profitable and promising field for telephonic enterprise. But instead of working that field, the directors had established two subsidiary companies, one in Bengal and another in Bombay; and, so far as he could trace, they had handed over their rights at these two centres without receiving anything for them. If they had received anything, what had become of it? But, besides, they had actually paid these subsidiary companies to work their rights. On the £98,000 of preference shares of the Bengal and Bombay companies, the directors had given a guarantee for five years of no less than eight per cent., involving a charge of over £6,000 a year, and they still held of these shares about £26,000 worth. What had become of the other £72,000 of these companies' capital. It could not all be required for working capital. Who had got these shares? Why was the eight per cent. guarantee given? All such questions should be answered by a perfectly independent and impartial committee (Hear, hear). In their circular, the directors had said that the movement of the requisitionists was an imputation against them. He had carefully refrained from making imputations against the directors. Was it an imputation to say that proprietors were not justified in enquiring into the affairs of their own property (Hear, hear). He begged to propose that a committee of investigation be appointed, consisting of four members of the company, with power to add to their number (Hear, hear). He would not read his names at that stage, but he might say they held a large amount of shares, and were all conversant with company matters (Loud cheers).

Mr. William Addison seconded the resolution. He explained that it was owing to a Mr. Macnab, a holder of 5,000 shares in Scotland, that he (Mr. Addison) had given his adhesion to the committee proposed. That gentleman had asked him to institute some enquiries, as he was not satisfied with the state of the company, and he (Mr. Addison) had also about the same time received the Consolidated Telephone Company's investigation committee's report. The consultation committee had come to nothing, and if the directors and they did not agree, the result was simply to throw dust into the eyes of the shareholders. They would find in the report that had been issued by that committee that the Oriental Telephone Company and its directors were frequently mentioned. (Hear, hear.) They would also see, on looking at their directorate, that the directors who were also on the Consolidated Company's board had it all their own way on account of the absentees from London at the present time. In answer to the objection that the appointment of a committee of investigation would depreciate the shares, he would say that the Consolidated shares, which were then at 3s., were now at 9s. or 10s. (Hear, hear.) That was one answer to the objection. There was another point which might be noticed. Most of the directors had their holdings in paid up shares. Consequently, their interests were antagonistic to those of the shareholders. It did not matter to them if all the rest of the money was called up. (Hear, hear.) Little information, they would find, could be got out of the auditors' report. It was all "We believe," "We are told," "It appears from information," and such like. It carried no weight for the shareholders when qualified in that way. (Hear, hear.) He might add that Mr. Edison, who was promoter and vendor of this company, and who had hitherto given his proxies to the extent of £16,000 to the directors, had now sent the requisitionists his proxy from New York. (Loud applause.)

The Chairman said that the mover of the resolution had stated that the members of their board who were directors of the Consolidated Company, had retired from the board of that company because the report of the committee of investigation of that company had charged them with breach of trust. Mr. Lloyd had certainly been more specific now than in his circular, and his statement had given him a very important clue to information he desired. One weekly paper had made a charge against the directorate in exactly the language which Mr. Lloyd had now used. It was absolutely untrue, and there was no such charge in either the first or second report of the committee; it seemed inconceivable that any one could have based such a statement upon either of those reports. He had put that newspaper, with copies of the reports, into the hands of a solicitor, with the simple question, Is this statement justified from these reports? The answer received was that there was not the slightest foundation in either the first or the second report. He was now informed that it was Mr. Lloyd who wrote that article. He was further advised that it was undoubtedly libellous, and probably further action would be taken in the matter, and they might have occasion to hear more on the subject. He would try in his remarks to do what the previous speakers had signally failed to do—avoid personalities. But he must say that he understood that Mr. Lloyd, who posed as the champion of the afflicted, had been employed for the purpose of the work he had in hand. Mr. Lloyd had said that it was the first report of the Consolidated Company that had occasioned the beginning of this agitation for a committee of investigation. Now before that report was issued, he (the speaker) had received a communication from a gentleman whom he did not know then nor now, which, briefly put, was to the effect that there was going to be a "devil of a row" in the Consolidated Company. The opening of the communication clearly implied that the row had not begun, but that something was coming, that there was going to be an attack on the directors common to both companies, and that they had better get out, or if they would not that they would be kicked out. (Laughter.) It added that they were all Yankees in control of that company, and that people had lost enough money already in American railroads. (Hear, hear, laughter, and interruption.) That, he need hardly say, was the very course of all courses in the world likely to make a man sacrifice his personal convenience in order to see the company through in a creditable and manly manner. Now with regard to the attacks made on the three directors of the Oriental Company, who had been connected with the Consolidated Company. Mr. Lloyd had stated in his circular that Mr. Carnegy and himself (the speaker) had resigned in consequence of that report. Those reports, first and second, contained no charge whatever against any of those gentlemen, He challenged any contradiction of that either now or hereafter.

Mr. Lloyd: I do contradict it most distinctly (Hear, hear).

The Chairman: Then, as I said before, it is most important that this report should be read, as you will probably not be disposed to take anybody's word in settlement of a question of this kind (Hear, hear).

The Chairman, continuing, reiterated that the resignation of the directors was not in consequence of that report. As to himself, he had, after notice of resignation, rejoined the board a year and a half after at the solicitation of the directors, and he only refrained afterwards from resigning on account of the inconvenience that it would have involved in calling a special meeting. As to the committee itself, he had himself seconded its appointment. Mr. Carnegy had resigned because of that report to this extent, that some very unmanly person had said at the meeting that he wished Mr. Carnegy would resign, and Mr. Carnegy instantly did resign. The resignation of himself and Mr. Carnegy from the other companies referred to was involved in their resignation from the Consolidated Company. As to Mr. Lloyd's other statements, he could only say that it was absurd to say they got nothing from the Bombay and Calcutta companies, as anyone would see on reading their reports. There was first a return of some £25,000 expended in establishing the business up to a certain time, and beyond that a very large profit in money. They got £34,000 for their £25,000 expended. In addition they had about two-fifths of the whole interest of the two companies. They secured a further working capital for the development of the business in those places, subscribed by local people to a large extent, some 600 native subscribers being in one company. It was not for him at that time to defend the guarantee of the preference shares. He could only point out that in the case of the Bombay company, the sale to the local company was made by the shareholders themselves after full explanation, when the board was also given the power to transact similar business themselves in future. It was in the exercise of those powers that the Calcutta company was shortly afterwards formed by the board itself on substantially the same lines,—only the public did not come forward so freely to take the shares. As to that sum of £6,000 per annum, it should only be £4,000, for the company retained itself a large part of the preference shares on which the eight per cent. was guaranteed. Besides, in the case of the Calcutta Company there was a provision for a reserve fund of one and a quarter per cent. upon an amount equal to that paid to the vendors, which was invested in government paper. That one and a quarter per cent. was put aside as a part of the working expenses. He held that it was susceptible of demonstration that that was the best way that the company could have secured for itself local support. The business receipts were constantly increasing in these companies, and the expenses were diminishing. One great cause of slow progress had been the policy pursued by the post office hitherto in this country, but they had an almost official assurance that a change now experienced in England would soon take effect in India likewise, and that would have an important bearing on their future The reason why the name of their company had been so often mentioned in the Consolidated committee's report, was connected with certain complicated transactions as to the purchase of 4,000 telephones which had really nothing to do with the Oriental company at all. As to his (the chairman's) own connection with the company, he had nothing to regret and there was nothing he had done that he would not do again if he had the same lights at the time of doing it. With regard to the Edison proxies, he must say that the board had been somewhat surprised a short time ago to hear that these proxies were likely to be voted against them. Just at the time when the requisition for a meeting reached the directors, the board themselves had called the shareholders together for an extraordnary meeting, and at that time not only the Edison proxies but many others were in their hands. Mr. Addison ought to have added to his statement that the Edison shares were bought. He had left the impression that Mr. Edison had given his proxies against the board. (Hear, hear, and interruption.) But he (the speaker) had a letter from Mr. Edison stating that he and Johnson, and Batchelor, his co-partners in the sale, had sold their shares and in doing so had been obliged to give a power of attorney to vote on them.

Mr. Oppenheim, amidst a scene of considerable confusion and interruptions, denied that he had bought the shares alluded to from Mr. Edison. He proceeded to say that he had done his best to back Mr. Lloyd through thick and thin in this matter, putting his office at his disposal, and giving him all the influence he possessed. They held over 100,000 shares, and they would be and must be successful. (Hear, hear.)

The Chairman, resuming, said that Mr. Edison had written to him saying explicitly that he believed his shares were bought on foreign account. In conclusion, he quoted figures to show the progress of the company. Last year the number of subscribers to the subsidiary companies and exchanges worked by the Oriental Company was 1,183. This year, for ten months they had 1,532, being an increase of 349, or 29 per cent. at the same rate of interest for the 12 months. The revenue for 1883 had been £19,800, and during the 10 months of 1884 it was £22,600, an increase ef £2,825, or about 14 per cent, or for a full year nearly 17 per cent. They had made a reduction in expenses amounting to upwards of £1,000 a year, of which £700 was in directors fees. In the ensuing year the reduction would be larger. The Egyptian company was working at a very large profit, and other subsidiary companies also at a profit. Referring to the question of the committee, he had to say that the consultative committee had had large powers which they never exercised. They had never come near the office as they had been asked to do.

Mr. Robinson Kendal moved an amendment, with a view to reconcile differences:—"That a committee, consisting of five shareholders, be appointed to examine, in conjunction with the board, all the affairs of the company, such committee to be composed of three shareholders directly nominated and elected by this meeting, and two nominated by the board and elected by this meeting also."

Mr. Veares seconded the motion, his remarks being much interrupted.

Mr. John Pender, M.P., who was received with cheers, thought that the matter lay in a nutshell. He would ask the chairman to grant what had been asked—a fair and impartial committee of investigation. (Loud cheers.) He knew all the difficulties that surrounded such a company, but he could say that when he left the board of the Oriental Telephone Company no company in existence was in a sounder position, and it had materially increased since. The company only required careful nursing. (Hear, hear.) They had got in India the best field possible, and their Egyptian Company, successful as it was, was likely to be much more so when Alexandria was rebuilt.

Mr. Ackers warned the meeting against being led away by any side wind to give the slightest extra power into the hands of the present directors. He had supported those gentlemen as long as he could. He could support them no longer, and he hoped there would be no attempts to engraft a preponderating element of the board upon the committee of investigation.

An irregular conversation ensued, in which Mr. Pender, Mr. Lloyd, Mr. Kendal and the chairman took part in the question of how the proposed committee should be elected. Ultimately at the chairman's request, Mr. Kendal drafted his amendment as follows: "That a committee consisting of five shareholders be appointed to examine in conjunction with the board into all the affairs of the company, such committee to be composed of three shareholders directly nominated and elected by this meeting, and two shareholders nominated by the board and elected by this meeting."

Mr. Bigelow, one of the directors, declined to have anything to do with naming an investigating committee. He knew there was nothing wrong, and he was not going to interfere in any way with the committee. (Hear, hear.)

Mr. Kendal thereupon agreed that the phrase "in conjunction with the board" should be deleted; and the Chairman then put the resolution as amended, thus: "That a committee consisting of five shareholders be appointed to examine into all the affairs of the company, such committee to be composed of three shareholders directly nominated and elected by this meeting, and two nominated by the board and elected by this meeting."

The amendment was rejected by a large majority, there being only ten supporters.

The Chairman then put the original resolution: "Resolved, that a committee of investigation be appointed to examine into the affairs of the company, with power to enquire into and report upon all agreements effected with subsidiary and other companies, and that such committee shall consist of five members of the company, with power to add to their number."

The resolution was carried on a show of hands.

The proposed members of the committee were then nominated separately and elected as follows: Mr. W. Addison (holding 2,000 shares); Mr. George Bland Frost (1,236 shares); Mr. Martin Jaffe (1,000 shares); Mr. Thomas Lloyd and Mr. St. John Ackers.

Mr. Lloyd then moved the second resolution included in the objects of the meeting, that five members be added to the directorate.

Col. Stewart moved that this be deferred till the shareholders had the report of the investigation committee.

Mr. Ackers reminded the meeting that the directors had pledged themselves to resign in the event of the committee being appointed.

The Chairman said Mr. Ackers was perfectly right, only they had spoken of an obviously hostile committee. He thought the only element not hostile was, now, Mr. Ackers himself, who would keep the committee straight if they were inclined to go crooked. He should prefer that directors should be elected without delay, as it was not the intention of the board to remain responsible for the position of a company with a committee of investigation going on within its four walls. (Hear, hear.) Unless they elected directors, they would have a company without directors.

The amendment was then withdrawn, and the following five gentlemen were elected to the directorate:—Mr. G. Cavendish-Bentinck, M.P., Mr. St. John Ackers, Mr. William Addison, Mr. John Battams, and Sir Alexander Armstrong.

A resolution for the alteration of a clause in the company's articles with regard to directors' fees stood on the agenda list for a subsequent second extraordinary meeting. The chairman announced that this item of business would be withdrawn, and the proceedings thereupon terminated, having lasted for three hours.

## Provincial Brush Electric Light and Power Company, Limited.

THE second ordinary general meeting of this company was held at the offices of the company, 68A, Cow Cross Street, E.C., on Monday, under the presidency of Mr. Thomas Fry, chairman of the company.

The Secretary having read the notice convening the meeting,

The Chairman said the meeting had been called to be held at the factory in order that the shareholders might realise the full significance of the change in their position, and see of what importance it was to them that they had a large interest in a manufacturing company for whose accumulators there was a growing demand. He need not tell them that nearly all the electric lighting companies had lately fallen on very bad times. It was thought when this company was started, with other kindred companies, that to have gained a concession from the Brush Company, no matter at what cost, was all that was required to lay the foundation of a profitable business. Then came the Electric Lighting Act of 1882, and it was then believed that if they could only secure Provisional Orders, success was certain. But, as they knew, all these hopes and expectations were soon rudely shattered. They saw the Scottish Brush Company retire very early from the field; then came the collapse of the Metropolitan Company, which brought disaster on the shareholders and also affected prejudicially the interests of all other companies. Now they heard that the Great Western and Midland Companies, not desiring any longer to walk alone, had resolved to return to the parent nest. These companies, no doubt, could only work under the licenses granted them by the Brush Company, and therefore the business they could do could be as well done by the Brush Company. But the position of this company, the directors considered, was entirely different. They were doing a business independently of the Brush Company; they were, through their association with the Consolidated Company, in possession of a system which they thought would be adopted very generally for electric lighting. Looking at the state of things in the case of other and larger companies, they considered that their position, although they had made a moderate loss, was in the main satisfactory, because they believed that in making that loss, they had laid the foundation of a profitable business. He must refer now to the working of their system by the South Eastern Company at Colchester, because they had a like interest with the South Eastern in the adoption of that system in other places. They claimed that at Colchester an undoubted scientific and mechanical success had been attained, and they believed this would be followed in due time by commercial success. They thought they had got over many of the preliminary difficulties, and they were now from day to day obtaining an accession of business that would be greatly to their advantage. Not only did they regard the success at Colchester as establishing the practicability of their system, but the public notice that had been taken of what had been done there had brought them a very large amount of business, which had come to them without solicitation and from all parts of the world—from Portugal and Spain in the way of actual business, and enquiries from India, Canada, New Zealand, Russia, Sweden and Italy. Therefore they considered that with their present working arrangements with the South Eastern Company, and the interest they had in the Consolidated manufacturing company, a certain amount of business was sure to follow. The lighting of the city of Lisbon had been determined upon, and a preliminary order had been executed to the extent of about £1,000; the whole order was worth £32,000, and so certain was the business that money was lodged in a bank here which the board could draw against the shipment of plant. This company was interested conjointly with the South Eastern Company in the execution of that order, both being interested in the Consolidated Company, and both contributing alike to the funds for the support of that company. They considered that they now had a fair prospect of doing a profitable business at a comparatively small cost. They knew that outside the board an approach had been made to the Brush Company with the view of coming to some arrangement similar to the arrangement carried out by the Midland and Great Western Companies, but at present the directors could not see that there was any basis for such an agreement. The Brush Company, they were told, was ready to take over, on certain terms, the whole of their assets; but would it take over their liabilities, liabilities which they had accepted in connection with the Consolidated Company, and which he thought they were bound to meet? He doubted very much if they were to approach the Brush Company, if they would find that there was any basis whatever upon which they could treat. That being so, he thought they could do better standing alone by continuing their own business. He concluded by moving the adoption of the report and accounts for the year ending June 30th.

The report stated "That the reduction of the capital necessitated an entire change in the policy of the directors with respect to the provisional orders, inasmuch as it rendered it impossible to provide funds for paying the deposits, and proceeding with the establishment of lighting stations.

"Under these circumstances, the directors decided upon developing their business as contractors for other companies, local authorities, &c., in which course they have been materially assisted by the evidence afforded at Colchester of the practicability of house to house lighting from a central generating station, with subsidiary storage stations.

"The directors have made arrangements with the South Eastern Brush Electric Light and Power Company, Limited, for undertaking business on joint account in any part of the world, reserving to each company the special rights in the English counties secured to them by the concessions from the Anglo-American Brush Corporation, Limited. This arrangement has been already acted upon in respect of the Lisbon contract and other business.

"By an agreement with the Anglo-American Brush Corporation, Limited, the licenses granted have been modified, so as to leave this company perfectly free to purchase dynamo machines and lamps from any manufacturers they like, the Anglo-American Brush Corporation, Limited, being permitted to trade in this company's district on payment of a commission of 10 per cent. on the sales effected. The discount allowed to this company being increased by an allowance of 10 per cent. after deducting the 20 per cent. provided for in the original agreements.

"With a view to economy, the offices of the company have been removed to 68a, Cow Cross Street, E.C., and the rent is simply nominal. The salaries have been reduced, and the directors have not taken any fees since 31st March, so that the working expenses at the present moment have been brought under £800 a year.

"Although less unfavourable than those of last year, the accounts presented with this report are affected by the difficulties incidental to the establishment and development of an entirely novel business. The result of the working for the year ending 30th June last, is a loss of £2,270 2s. 10d., and the directors recommend that this amount be carried to suspense account.

"It should be borne in mind, however, that this company possesses 20,000 shares of £1 each in the Consolidated Electric Company, or one share for every share held in this company, and, as the Consolidated Company's shares have now a marketable value (many having been transferred for a substantial consideration during the last two months), the value of the Provincial Company's shares is enhanced accordingly."

Mr. Wapshare seconded the adoption of the report and accounts, and in doing so said he would give them some information as to the present position of the Consolidated Company. Having taken a lease of the adjoining premises, the company was in a position to do a very extensive business—to the extent of £30,000 or £40,000 a year in secondary batteries alone. There were indications of very large orders coming in, by which, of course, the Provincial Company would benefit. He attached the greatest importance to their battery. They were prepared to make three kinds of cells: one to contain 11 plates, returning 170 amperes; another of 15 plates, returning 240 amperes; and another of 19 plates, returning 300 amperes—all discharging at 25 amperes. The latest test was of a 15 plate battery, which returned 300 amperes, discharging at 23 amperes, or, in other words, running from 13 to 14 hours without any fall worth mentioning in the E. M. F.; each cell gave 2 volts. There were daily increasing signs of the growing demand for electric lighting, and a concensus of opinion that only by storage could success be obtained. They were asked to estimate for the lighting of the Royal College of Physicians by secondary batteries, and also for several mansions in Sloane Street, and there were various local bodies in treaty with them. With regard to the cost of the batteries, they got a higher electrical result from 56 lbs. of material than the only other practical battery in the market got from 70 lbs. of material, and, therefere, they could produce so much cheaper. As to Colchester, doubts had been raised as to whether the B. T. K. system was a success. He visited Colchester last week, and found the lights all burning brilliantly, and all the consumers expressing satisfaction. Of course Colchester was not self-supporting yet, for there were not enough lights, but they estimated that 1,000 lights would more than pay, and if it were taken up on a large scale it would return handsome results.

Mr. R. Braithwaite submitted an amendment—"That the report and balance sheet be not at present adopted, and that this meeting do stand adjourned for one month; and that Mr. William Hewitt, Jun., and Mr. C. H. Stewart, with power to add to their number, be appointed members of a committee to inquire into and report upon the present position of the company, and to report as to the best course to adopt in the interests of the shareholders."

Mr. Comberbach seconded the amendment, which was put to the meeting and lost, the original motion being afterwards put and carried by a large majority. A poll was demanded, and was directed to be taken on Monday, the 29th inst., between the hours of 11 and 3.

The retiring directors, Messrs. Cunningham and Fry, and the auditors, Messrs. Price, Waterhouse & Co., were re-elected, and the meeting terminated.

## Anglo-American Brush Electric Light Corporation, Limited.

An extraordinary general meeting of this company was held at the offices, 112, Belvedere Road, Lambeth, on Monday; Mr. J. S. Sellon presiding.

Mr. Emile Garcke having read the notice convening the meeting,

The Chairman said the matter for consideration was the provisional agreement entered into with the Great Western and Brush Midland Companies. He would ask them to accept, as a matter of course the fact that the directors had fully considered the bearing of the proposed amalgamations or absorption of the interests of the two sub-companies, and he would also ask them to accept as a matter of trust the policy which the directors had laid down. Briefly summarising the effect, the total number of fully-paid shares which it was proposed to issue to the two companies was 33,475, for which this company received plant and installations, land, buildings, and stock, which might fairly be estimated as worth £16,750; in cash, £7,700, and in unpaid calls about £4,100, leaving a deficit of £5,000; against which this company received back the licenses, and secured the whole of the 28 counties, at present out of their control. He could confidently recommend the acceptance of the agreements as they were now offered; and, if they were accepted, he had no doubt the ultimate result would be one of satisfaction to the shareholders of the Anglo-American Company as well as to the shareholders of the two sub-companies. He then moved: "That the provisional agreements entered into between the Corporation and the Great Western Electric Light and Power Company, Limited, and the Brush Midland Electric Light and Power Company, Limited and Reduced, dated respectively 28th November, 1884, and 29th November, 1884, and submitted to the meeting, be and the same are hereby sanctioned, adopted, and confirmed, and that the directors be authorised to carry the same into effect respectively with or without modifications, and for that purpose to enter into and execute all necessary deeds and documents, and to issue not exceeding 6,695 fully-paid £5 shares in the capital of the Corporation, such shares to be numbered from 40,701."

Mr. Herbert Gibbs seconded the resolution.

The Chairman said that one letter only had been received from a dissentient shareholder, whilst the board held about 30,000 proxies in favour of the agreements.

Mr. Meers opposed the resolution, not out of an antagonistic feeling, but because he considered a much higher price had been offered for the shares of the sub-companies than they could have been obtained for on the Stock Exchange; and because the shareholders of the Anglo-American Company were unaware of the exact position of their own affairs. He suggested the adjournment of the meeting for a month, by which time the annual report and accounts would be in the hands of the shareholders. He stated that the shares of the sub-companies had gone up, in one case 100 per cent., in consequence of the negociations with this company.

The Chairman said the directors entirely ignored the Stock Exchange, and would not accept as bases for negociation the prices at which one company or the other might be quoted on the Stock Exchange. Even supposing they were to attempt to buy up the shares of the two companies, which they were not entitled to do, the prices would go up considerably before they were able to purchase more than a few shares. The directors had endeavoured to arrive at the value of the assets of those companies as they stood, and they had also endeavoured to the best of their ability to arrive at the valuation at which the absorption of the two companies could be estimated in enabling them to carry out their intended policy. The reason the meeting was held so shortly before the annual meeting was that it was considered desirable to close up all these matters before the new year, so that in the accounts and general statement at the annual meeting there would be no complications.

The motion was then put and carried, the meeting thereupon terminating.

## Great Western Electric Light and Power Company, Limited.

An extraordinary general meeting of this company was held at the offices, 4, Great Winchester Street, E.C., on Tuesday, for the purpose of confirming a special resolution passed at a meeting of the company held on the 8th inst.; Mr. J. B. Braithwaite, jun., chairman of the company, presiding.

The secretary, Mr. Allender, having read the notice convening the meeting,

The Chairman moved the confirmation of the following resolutions:—"That the conditional agreement submitted to this meeting, and made between this company of the one part and the Anglo-American Brush Electric Light Corporation, Limited, of the other part, be, and the same is hereby approved and sanctioned." "That with a view to carrying the said conditional agreement into effect, the company be wound up voluntarily, and that Mr. Emile Garcke and Mr. F. W. Reynolds be, and they are hereby appointed liquidators, for the purpose of such winding up." "That pursuant to the Companies' Act, 1862, the said liquidators be, and they are hereby authorised and directed to adopt, on behalf of this company, the said agreement, and to receive paid-up shares in the said corporation, as consideration for the property thereby agreed to be sold in accordance with the terms of such agreement, and generally to carry the same into effect." In doing so he said the board had again received a very strong expression of opinion from the shareholders in favour of the proposed amalgamation.

Mr. Stewart seconded the resolution, which was carried, the meeting thereupon terminating.

# CORRESPONDENCE.

### Telephone Lines.

I have read your article in last week's issue on "Telephone Lines," and whilst concurring with the views you express as to the lineman's difficulty in tracing for faults, I would point out what appears to me to be unsatisfactory in your suggestions. You say; "with the parallel system, with crossings at certain points—say every quarter or half-mile pole—all these difficulties disappear." Now, as you are probably aware, the wires running on many routes are of various lengths, and not infrequently a "private" line is picked up and run some distance. If, then, we will suppose a "private," or a short "exchange" line be run alongside for the distance either of the whole or part of one section only, we shall not have that "*balance*" which the present "twists" so fairly afford in such cases, the results being precisely what might be expected from running ordinary plain loops. At the same time I do not doubt that if your suggestions were acted upon, *with crosses at each pole*, an improvement might be the result.

**Arthur E. Cotterell.**

The Laurels, Greenhill Road,
Moseley, B'ham,
*December 22nd*, 1884.

### On Measuring Small Resistances.

In an article in your issue of the 13th inst., by Mr. F. Uppenborn, attention is called to a very valuable method of testing, first introduced by Messrs. Matthiessen and Hockin.

This method is of especial value in determining the temperature produced in a wire by the passage of a given current. In the ordinary method, when the extremities of the wire experimented on are attached to massive copper terminals, at the temperature of the air a correction for loss of heat by conduction is necessary, which correction Sir William Thomson has furnished in a note appended to a recent paper by Mr. Bottomley on this subject. This correction is somewhat complex, and may be entirely avoided by the method which Mr. Uppenborn has noticed, in which the galvanometer contacts can be shifted towards the centre of the wire.

For the last three years I have used this method, and during that time, having taken many thousands of observations, I can speak from experience as to its utility and great convenience.

Mr. Uppenborn refers also to a system of calibration which he attributes to Messrs. Strouhal and Barus. I do not know the date of their paper on the subject, but it was devised independently by myself in 1881, and is fully explained in a paper of that date communicated to the British Association, and of which I enclose a copy.

The mode proposed by Mr. Uppenborn of correcting the inequalities in the wire by the use of emery paper, is, in my opinion, very objectionable and quite unnecessary. A German silver wire is easily procured, in which the resistance is nearly uniform, and if this is found not to be the case in a particular wire, it is better to discard it and try another sample.

With all precautions, however, some want of absolute uniformity is sure to be found; and it is best to calibrate in the manner referred to, and prepare a table showing the necessary correction to be made on any observed reading.

I also consider the length of wire (1·2 metres) suggested by Mr. Uppenborn insufficient to obtain the full advantage of this system of testing. The wire I employ is of platinum-iridium, 12 metres long, 1·75 mm. in diameter, and is wound on a drum in twenty convolutions; this wire has many advantages over German silver, being harder and not liable to injury from acid or mercury; its only drawback is its high cost, about 50s. per ounce.

**Herbert Taylor.**

7, Pope's Head Alley, Lombard Street,
*December 18th*, 1884.

### Incandescence Lamps for Magic Lanterns.

After reading a letter by "Auto," in your journal of this week, I am tempted to say a word on the subject of incandescent lamps for magic lanterns. For a long time past I have used a pair of dissolving view lanterns, fitted with 50 candle-power Swan lamps (100 volts), with perfect success.

It is very easy to dissolve, because this can be effected either by a resistance frame being employed or without by simply turning on both lamps, and shutting off the one last in use. My lanterns are so arranged that one lever does the whole work, and a resistance (to make the dissolving very gradual) or not may be used, the switch having many steps.

The lamps must be adjustable up and down, as well as to and from, the condensers.

**David Salomons.**

Broomhill, Tunbridge Wells,
*December 28th*, 1884.

### Compounding Dynamos.

I notice that there is a mistake in my letter asking "How to Compound a Dynamo?"

For "series dynamo" should be read "shunt dynamo." I fancy the mistake was through a clerical error of my own.

If you could find space to reinsert the letter with the above correction in your next issue you would much oblige,

**W. McWilliam.**

Invergarry, Crouch Hall Road,
Crouch End, N.,
*December 20th*, 1884.

[We noticed the point our correspondent mentions; the mistake was, as he assumes, his own.—EDS. ELEC. REV.]

### Electric Lighting Act.

I observe in your last issue a list of the members of a committee promoted by the Anglo-American Brush Electric Light Corporation, Limited, to confer with the Board of Trade on the amendment of the Electric Lighting Act and Provisional Orders of 1882 and 1883. A brief examination of the names and connections on that list will suffice to convince anyone that it does not fairly represent the electric lighting industry.

The Anglo-American Brush Corporation, Limited, and the Edison and Swan United Company, Limited, are probably by arrangement in the majority, and that these two companies govern the committee seems clear by the election, by ballot, of ten of those members to form the executive committee, all of whom, I believe, belong or are connected with one or the other of the two companies before named. It is obvious that such a committee is not representative; it does not represent $\frac{1}{100}$th part of the interests involved, and on that account, if it is to have the confidence of the body of electric light engineers and others interested, and to be in a position to carry through such alterations in the Electric Lighting Act and Provisional Orders as are considered necessary, it should be remodelled so as to include:—

1. Other electric light companies in a fair proportion. 2. Kindred companies, such as telegraph cable and wire companies, steam and other motive power companies and firms. 3. Private electric light contractors. 4. Consulting electric light engineers, borough engineers, &c. 5. Civil and electrical engineers generally.

It is a well known fact that private electric light firms are doing more business in electric lighting than all the companies put together, and it is obviously unfair that they should not be represented. In its present form the executive committee only speaks for the two companies, viz., the Anglo-American Brush Electric Light Corporation, Limited, and the Edison and Swan United Electric Light Company, Limited, and only represents company interests, at present the weakest of all the electric lighting interests, and unless the committee be remodelled, I would advise the private firms and others I have indicated to form a committee to look after and advance their own special interests. I should like to know how the committee will work with that appointed by the "Dynamicables." The "Dynamicables" have produced a very excellent and well-timed report on the subject, and they are far more representative than the two companies can ever be. At a recent meeting of the "Dynamicables," I pointed out the advisability of their working and presenting their report in conjunction with the Institution of Civil Engineers, the Society of Telegraph Engineers, and other such well-known and established societies. I would suggest that instead of the disjointed and weakened efforts of special and independent committees, that the proper and most forcible way of obtaining the repeal and alteration of the Electric Lighting Act and Board of Trade Provisional Orders will be by a combination of the companies' committee, the "Dynamicables," and as many of the undermentioned institutions and societies, and such like bodies, as may be induced to join, viz.:—The Institution of Civil Engineers, the Society of Telegraph Engineers, the Royal Society, the Royal Institution of British Architects, the Society of Engineers, the Society of Arts, the Iron and Steel Institute, and others. The arrangement and management to be placed in the hands of the "Dynamicables," who have shown themselves eminently qualified for such a position. Such a combination, representating, say, 50,000 men, all more or less specially interested in the subject, would be all-powerful to fight the large competing interests of the gas companies, and to deal with the local authorities; the labours of such a combination would be treated with the respect due to the large body of the best class of the men in the country they represent. I submit that all the societies mentioned, the companies and private firms, who all desire the advance of electric lighting, would assist in such a combination, and help us to get out of the present slough of despondency, brought on by disreputable company mongering and interested cliques. The favourable revision of the Electric Lighting Act and Provisional Orders are necessary, and would materially help the electric lighting industry, and no doubt lead to the public lighting of large areas. The interests involved in such work are enormous, and it behoves all who wish to share in the prosperity in prospect to unite to prevent the combination of any two or more companies from practically arranging the terms to suit their own special views, and monopolising the advantages; at the same time with very doubtful chances of ultimate success in securing alterations at all. On the other hand, the combination such as I have outlined would have the confidence of everyone, and would no doubt be able to secure the alteration in the Acts and Provisional Orders we all so much hope to see.

Perhaps you will give your own views on this all-important matter.

**Henry F. Joel.**

Tower Chambers, Moorgate Street, E.C.
*December 22nd*, 1884.

[We would refer our correspondent to our leading columns.—EDS. ELEC. REV.]

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